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GHOSTS AND GOBLINS.

By Richard A. Proctor.

(*Continued from page* 180.)

As an instance of a story which has been unwisely insisted upon by believers in the supernatural, I take the marvellous narrative of M. Bach and the old spinet. As given in outline by Professor Wallace, it runs thus—"M. Leon Bach purchased at an old curiosity shop in Paris a very ancient but beautiful *spinet* as a present to his father (a great-grandson of Bach, the great composer), a musical amateur. The next night the elder Bach dreamt that he saw a handsome young man, dressed in old court costume, who told him that the spinet had been given to him by his master King Henry. He then said he would play on it an air, with words composed by the King, in memory of a lady he had greatly loved; he did so, and M. Bach woke in tears, touched by the pathos of the song. He went to sleep again, and on waking in the morning was amazed to find on his bed a sheet of paper, on which were written, in very old characters, both words and music of the song he had heard in his dreams. It was said to be by Henry III., and the date inscribed on the spinet was a few years earlier. M. Bach, completely puzzled, showed the music to his friends, and among them were some spiritualists, from whom he heard, for the first time, their interpretation of the phenomena. Now comes the most wonderful part of the history. M. Bach became himself a writing medium; and through his hand was written involuntarily a statement that inside the spinet, in a secret niche near the keyboard, was a parchment, nailed in the case, containing the lines written by King Henry when he gave the instrument to his musician. The four-line stanza, which it was said would be found on the parchment, was also given, and was followed by the signature—Baldazzarini. Father and son then set to work to search for this hidden scroll, and after some two hours' close examination found, in a narrow slit, a piece of old parchment about 11 in. by 3 in., containing, in very old writing, nearly the same words which M. Bach had written, and signed—Henry. This parchment was taken to the Bibliothèque Impériale and submitted to experienced antiquarians, and was pronounced to be an undoubtedly genuine autograph of Henry III."

"This is the story," says Prof. Wallace, and proceeds to dwell on the care with which Mr. Owen, who narrates it (in "The Debatable Land between this World and the Next"), had examined all the details. "Not content with ascertaining these facts at first hand, and obtaining photographs of the spinet and parchment" (!) "of both of which he gives good representations, Mr. Owen sets himself to hunt up historical confirmation of the story, and after much research and many failures, he finds that Baltasarini was an Italian musician, who came to France in 1577, and was in great favour with Henry III.; that the King was passionately attached to Marie de Cleves, who became wife of the Prince de Condé, and that several of the allusions to her in the verses corresponded to what was known of her history. Other minuter details were found to be historically accurate." (In other words, "the bricks are alive this day to testify it; therefore, deny it not.") "Mr. Owen also carefully discusses the nature of the evidence, the character of the persons concerned, and the possibility of deception. M. Bach is an old man of high character; and to suppose that he suddenly and without conceivable motives planned and carried out a most elaborate and complicated imposture, is to suppose what is wholly incredible." (That is, we must not suppose so because we cannot suppose so.) "Mr. Owen shows further that the circumstances are such that M. Bach could not have been an impostor even had he been so inclined, and concludes by remarking, 'I do not think dispassionate readers will accept such violent improbabilities. But if not, what interesting suggestions touching spirit-intercourse and spirit-identity connect themselves with this simple narrative of M. Bach's spinet!'"

Here is a story which to most readers, I venture to say, appears absurd on the face of it, suggesting not "interesting," but utterly ludicrous "ideas of spirit intercourse;" yet we are to believe it, or else indicate exactly how our doubts are divided between Mr. Owen himself (who may have been somewhat misled by his evidence), the Bachs, father and son, the spiritualist friends who instructed M. Bach how to become "a writing medium," and so on.

Again, we are to believe all such stories unless we are prepared with an explanation of every circumstance. It seems to me that it would be as reasonable for a person who had witnessed some ingenious conjuring tricks to insist that they should be regarded as supernatural, unless his hearers were prepared to explain the exact way in which they had been managed. Indeed, the stress laid by the superstitious on narratives such as those related by Mr. Owen is altogether unwarrantable in the presence of all that is known about the nature and the laws of evidence. In works like Mr. Owen's the author is witness, judge, and advocate (especially advocate) in one. Those who do not agree with him have not only no power of cross-examining, but they commonly have neither time nor inclination to obtain specific evidence on their side of the question. It requires indeed some considerable degree of faith in the supernatural to undertake the deliberate examination of the evidence adduced for ghost stories—by which I mean, not the study of the story as related, but the actual questioning of the persons concerned, as well as an examination of the scene and all the circumstances of the event. Therefore I cannot see any force in the following remarks by Professor Wallace:—"How is such evidence as this" he says, speaking of one of Owen's stories, "refuted or explained away? Scores, and even hundreds of equally attested facts are on record, but no attempt is made to explain them. They are simply ignored, and in many

cases admitted to be inexplicable." Yet this is not quite satisfactory, as any reader of Mr. Owen's book will be inclined to admit. *Punch* once made a Yankee debtor say:—

> This debt I have repudiated long ago;
> 'Tis therefore settled. Yet this Britisher
> Keeps for repayment worritting me still.

So our philosophers declare that they have long ago decided these ghost stories to be all delusions; *therefore* they need only be ignored; and they feel much "worritted" that fresh evidence should be adduced, and fresh converts made, some of whom are so unreasonable as to ask for a new trial, on the ground that the former verdict was contrary to the evidence.

All this affords excellent reason why the "converts" should not be ridiculed for their belief; but something more to the purpose must be urged before "the philosophers" can be expected to devote very much of their time to the inquiry suggested. It ought to be shown that the well-being of the human race is to some important degree concerned in the matter, whereas the trivial nature of all ghostly conduct hitherto recorded is admitted even by "converts." It ought to be shown that the principles of scientific research can be applied to this inquiry; whereas, before spirits were in vogue the contrary was absolutely the case, while it is scarcely going too far to say that even the behaviour of spirits is to be tested only by "converts," and in the dark. It ought, lastly, to be shown that the "scores and even hundreds" of well-attested facts, admittedly singular, and even, let us say, admittedly inexplicable, are not more in number than the singular and *seemingly* inexplicable facts likely to occur (by mere casualty) among the millions of millions of events which are continually occurring; but this is very far from having been as yet demonstrated: on the contrary, when we consider the scores and hundreds, and even thousands of facts which, though they have been explained, yet seemed for awhile (and might have remained for ever) inexplicable, the wonder rather is that not a few books like Mr. Owen's, but whole libraries of books, have not been filled with the records of even more singular and inexplicable events.

THE SUN'S ATMOSPHERE.

By W. Mattieu Williams.

On page 166 (Knowledge, March 14), Mr. Proctor expounds a difficulty on which I have often pondered—viz., that presented by the actual density of the sun contradicting so positively the density which is theoretically due to the self-condensation of his immense atmosphere by its own pressure.

The old idea that the dark nucleus of the spots is the comparatively cool surface of a *solid* body underlying the luminous atmosphere need not be discussed. We now know sufficient of the materials resting on the sun to understand that in viewing such a nucleus we are looking into the profundity of a dark abyss of intensely heated matter, which is dark simply because it contains no solid or liquid particles capable of reflecting light. Recent investigations have shown that gaseous matter, free from solid or liquid particles, gives out no light even at what we call a "white heat" of the greatest obtainable intensity.

Assuming that the photosphere is the superficial region in which occurs the recombination of dissociated gases from within, and that the spectroscope tells us the truth concerning its materials, there must be a definite limit to its temperature, as such gases cannot combine at a temperature reaching that which effects their dissociation; but the dissociated elementary gases of the inner depths may attain any conceivable temperature, and therefore become hotter and hotter at greater and greater depths. This increasing heat (*i.e.*, increasing repulsive energy) may at some point balance the pressure due to the gravitation of the superincumbent gaseous mass, and this critical point once reached, the balance of opposing forces may continue even to the centre of the solar mass, as further condensation could not be effected by the pressure without simultaneously developing more heat to overcome itself.

According to this view the maximum density of solar matter may be reached at a comparatively moderate depth below the photosphere, and be no further increased, even down to the very centre, in spite of the enormous magnitude of this orb.

Something like this must be supposed, or we must throw overboard all the revelations of the spectroscope, and assume that the sun is composed of matter utterly different from anything terrestrial; for if it were merely a great bubble of hydrogen gas, its mean density would (without such critical limit to compression) vastly exceed that which its own magnitude and the rates of planetary revolution prove it to possess.

Some of the readers of Knowledge will probably remember that I expressed this idea of the critical condition of the materials of the sun at the conclusion of my papers on "Solids, Liquids, and Gases" (Vol. I., p. 157), as follows:—"Applying now the researches of Dr. Andrews to the conditions of solar existence, as I formerly applied the dissociation researches of Deville, I conclude that the sun has no nucleus, either solid, liquid, or gaseous, but is composed of dissociated matter in the critical state, surrounded, first by a flaming envelope, due to the recombination of the dissociated matter, and, outside this, another envelope of vapours, due to this combination." For the further reasons on which this conclusion is based, I must refer to that paper.

Besides the above-stated difficulty, there is another atmospheric mystery connected with the sun which is still more paradoxical.

Far away, more than a million of miles beyond the surface of the photosphere, the spectroscope reveals gaseous matter, "*helium*" it has been named. What is this? That it should be an actual atmosphere extending so far beyond the sun is inconceivable, unless we construct a special ether from the materials of our own imagination and transfer it to the sun to serve this particular purpose.

Nevertheless, we need not despair. I think we may find an explanation of this mystery without transcending experimental fact.

Assuming that my explanation of the corona (see "Fuel of the Sun") is correct, viz., that it is mainly composed of matter ejected by the prominences, originally gaseous, but more or less condensed into liquid and solid masses in the course of its flight, and also that I am right in supposing that the ferruginous meteorites that fall on our earth may, some of them, be samples of extreme ejection, the helium mystery is solved at once.

Graham proved, and others have reproved, that such meteors contain large quantities of occluded hydrogen, which pours out when a fragment is heated in vacuo. If, then, the corona consists of a thick hail of such meteoric matter newly ejected from the bowels of the sun wherein the occlusion of the compressed hydrogen was effected, every one of these fiery hailstones must be vomiting its occluded hydrogen, &c., as it flies outward into comparatively vacuous space, and these streams of occluded gas must outspread themselves violently when thus released in such approximate vaccuum.

I will even go so far as to predict the chemical composition of the material which supplies the ·1474 line.* I believe that by properly operating upon meteoric iron with the apparatus required, we shall find it to be hydrogen gas holding iron in solution; ferruretted hydrogen gas, analogous to the arseniuretted hydrogen obtained in using the well-known Marsh's test for arsenic; and to other corresponding compounds.

I have tried to produce it artificially, but without decided success, with a degree of failure fairly attributable to want of appliances for proving its existence, rather than to its actual non-existence.

HINTS ON ROWING.

By an Old Club Captain.

IT is singular how unapt are most beginners in any form of exercise to consider the special aim and purpose of the exercise. They mostly try to acquire, only, the movements involved in the exercise. Thus the special object in tricycling is to work the outer rims of the driving wheels against the ground in such a way that the body of the tricycle and with it that of the tricyclist may be urged rapidly forward. But nine out of ten who begin tricycling, work as though the great object were to work the feet round the axle. In their zealous efforts to do this, it seldom occurs to them till they have been some time at work (many weeks in some cases) that they are using one leg against the other. They wonder that they make little progress, and soon get tired out; but the real wonder rather is that so many persevere in the wearisome task. At last the idea dawns on them that the tricycle is a piece of mechanism designed for a certain purpose, and that it is as well to direct their efforts to accomplish that purpose, and not a purpose for which the machine was not devised. *Then*, putting out their strength in such a way that first one foot drives, the other carefully refraining from resistance, then the other takes its turn, and so forth, each stroke being mentally directed to bring round the driving rims as energetically as possible, the tricyclist finds his strength doubled and his labour halved,—or his effective work quadrupled. That which had been a weariness of the flesh becomes a pleasure.

With rowing the case is similar. Not only the beginner but in nearly every case the teacher also, proceeds as though the great object in rowing were to put the blade of an oar into the water in a certain way to bring it through the water, to feather it with skill and dexterity, and then to carry it back for another movement through the water. If both the beginner and the teacher consider the real purpose of rowing, a much better start will be made in the task of learning to row, and much quicker progress will be effected. Let the beginner regard his oar as a lever for urging the boat along, and let him consciously direct his exertions to that end, and he will from the beginning work on correct principles. He will *feel* that to get work out of his lever he must put the blade in squarely. He will *feel* that jerking and scooping must be useless and worse, and that hawling in any other way but parallel to the course in which the boat has to go must be bad. He may be troubled a little by the curved course which his hands have necessarily to take, but he will *feel* that the pull upon the oar must not vary correspondingly in direction, but should be made (and may pretty easily be made) always parallel to the boat's length. Presently he sees that to secure effective propulsion he may act as though his object were to propel the water backwards, and that the greater the amount of water driven along the surface backwards (no part of it being driven either upwards or downwards) and the more effectively it is so driven, the greater the propulsive effect on the boat,—action and reaction being always equal. This I have invariably found, when teaching the young idea to row, marks the beginning of an effective style. The learner from the time he notes this begins to send sternwards the kind of swirl which the coxswain and the stroke like to see, not a formless roughening of the water but a well-shaped and swiftly circling swirl which means work done by the backward propulsion of a goodly mass of water. In aiming, on his own part, to send down such a swirl, the learner, if he really means work, soon finds his way to all the good points of style. Beginning (as is generally best) with strokes not too long, he lengthens his stroke by forward reaching as his mastery of the oar increases, and so increases the mass of water sent sternwards. He carefully keeps his blade square that there may be nothing lost by the slip of the water over or under it. He keeps his blade well covered that no part of it may waste its power on the idle air; but he refrains from dipping it lower where no increase of power is to be found though the labour would be much increased. Then too he feels that at the end of his stroke the oar must be brought cleanly from the water or the backward swirl (which really means and measures the forward urging of the boat) will be impaired and the boat's way correspondingly checked. So he soon acquires the art of bringing the top of the blade above water just before the end of the stroke, then on the instant giving the blade a sharp half-turn by which the swirl is neatly finished off and sent down as a pleasing little Maelstrom besides the boat's wake. In going forward the oarsman, still rowing with his head as well as his hands, feels that he cannot do better that to keep his blade flat, for so it will least oppose the air and do least harm should a passing wave unluckily touch it. He will recover sharply, especially in a heavyish boat, because all the time he is not pulling the effect of his last propulsive effort is being exhausted. And he will square his blade at the very instant that the forward motion of his arms and hands ceases, and he is about to drop in the blade for a new propulsive effort.

Of course a good Mentor, though he may save himself ever so much trouble by reminding his pupil of the real object in rowing (the propulsion of the boat) can still be very useful to the learner by telling him how best to apply his strength by showing how the arms are most effectively used in conjunction with the swing of the body, not *alone* (as many strong-armed learners try to use them), by calling his attention to the necessity of a straight swing from the hips, and by many hints as to the use of hands and wrists, loins legs and feet. But the great point, I am persuaded, is to correct at the outset the idea that the object in rowing is to work the oar through air and water alternately, instilling instead the true ideas—viz., that the object is to propel the boat, that the oar is a most effective lever, the boat the weight levered, and the water the fulcrum, from which alone,—yielding or unyielding,—propulsive purchase is to be obtained.

On these principles I have taught a beginner more in two lessons than many learners acquire in a month's practice. My last pupil, for instance, was a lady, and a waterman who steered during the second lesson, spoke with approval of her *style*, where in reality there was nothing but the conscious endeavour to secure propulsive effect.

* A green line, not to be confounded with the orange-yellow line of Helium.—R. P.]

THE EVOLUTION OF FLOWERS.

By Grant Allen.

V.—TRUE LILIES.

THE flowering rush and the arrowgrass brought us so very near the true lilies in every important particular that we scarcely feel we have made any transition worth speaking of when we arrive at the simplest and most primitive existing members of the restricted lily family—the Liliaceæ of technical botanists. Of these simplest kinds we have two or three excellent representatives in our own country, quite as good as any we could get if we were to search the whole dried specimens of the Kew herbaria. The best of these for our present purpose is that rare little field lily, the yellow gagea (*Gagea lutea*).

Gagea lutea.

In a few sandy meadows of England and Scotlands, some straggling colonies are found of a pretty little golden lily, whose proper habitat stretches over the great central plains of Europe and the warmer portions of the Siberian slope. Like most other true lilies, this little plant is a dweller in the fields, while the Alisma-like kinds with which we have hitherto been dealing are all of them denizens of the ponds and marshes. Such a fact is in itself a significant one: the more advanced type has overrun the wide plains and uplands of the entire world, while the lower types have everywhere been crowded out into the less desirable habitats, such as water-courses, swamps, and hilltops. Like most other meadow-plants, too, our gagea has been forced, in competition with the grasses, to acquire long and narrow blade like leaves, so as to reach the air and light among the tall plants with which it has to struggle. Furthermore, it shares one common habit of a great many lilies in the fact that it possesses a bulbous root-stock. In this root-stock the starches and other food-stuffs laid by in one season are stored away for the use of the flower in the succeeding spring; and, as a general rule, it may be said that most bulbous lilies and other lily-like monocotyledons (including the very closely-allied iris and amaryllis families) are spring-flowering plants. There can be very little doubt that the prevalent bulbousness of the lilies is one of the points which has chiefly aided them in establishing themselves so widely and firmly as they have done in the very best situations over the entire world.

These, however, are not the peculiaries of the true lilies which chiefly strike the classificatory botanist. As a matter of structural development, the important particulars to note about the gagea, as compared with the flowering rush and the water-plantain, are chiefly these. The carpels, reduced to a single whorl of three, as in marsh arrow-grass, are here firmly united into a single solid ovary, which never at any time divides into its component parts, but opens in the centre of each carpel to shed the seeds. The stigmas (or summits of the carpels) are combined into a single style, which, however, in most lilies bears three separate stigmas at its top, as a last witness to their original distinctness. Each carpel contains several seeds—an advance which we already noted in the flowering rush. The stamens, instead of being numerous, as in arrowhead, or nine, as in flowering rush, are six in number, as in water-plantain. The general formula for the lily family (though subject to a few exceptions) is about as follows:—Perianth, of six divisions petal-like; stamens, six; ovary, free, three-celled; styles, single, with a solitary or tripartite stigma; seeds, usually many in each cell, sometimes solitary.

Now, what is the practical meaning of all this in its evolutionary aspect? Simply that the lilies have taken, for greater security of fertilisation, to running their three carpels together, and especially to uniting their three stigmas or sensitive surfaces into one, so that a single act of fertilisation suffices for the whole lot. Being all (in the main—about the exceptions we will speak hereafter) insect-fertilised, they have conspicuous-coloured flowers; and the sepals as well as the petals share in the attractive display. The lower lilies bear capsules with many seeds; in the higher ones, as we shall soon see, the development of berries has allowed the number of seeds to be still further reduced to three, or one in each carpel—called, in the case of united ovaries, a cell.

Our gagea thus possesses all the most important distinctive lily features, as compared with the flowering rush, the water plantain, and the other alismaceæ; but, in certain minor respects, it shows many signs of being a very primitive lily indeed. One need only compare the present illustration with the illustration of the flowering rush in order to see how markedly like the two plants are in the most notable external features. The flowers here are several in number, with leaf-like bracts beneath each flower-stalk, and the sepals and petals, instead of being bell-shaped, as in the tulip and wild hyacinth, or combined into a single piece, as in the lily of the valley and the garden hyacinth, are quite distinct and broadly spreading, as in the flowering rush. In fact, whilst most other lilies display the common lily features, with some special modifications and additions, such as tubular corollas, fleshy-coloured berries, flattened stamens, abortive leaves, and so forth, the gagea displays them almost in their uncompounded purity, without any complications or additions of any sort. It thus shows itself to be a survival from a very primitive and simple form of the common liliaceous stock. There are, however, a few other lilies which, while more advanced in some ways than gagea, yet preserve some more antiquated or original features which this little plant has entirely lost.

Indeed, the Scottish asphodel (*Tofieldia palustris*) perhaps still more closely resembles the earliest lily ancestor in most important respects, especially in the fact that, like the arrowgrass, it has three distinct and separate styles—a very archaic characteristic, certainly; but, for some other reasons, I incline to consider the Tofieldia genus as a degenerate one, and so have not chosen it as my first representative of the true lily group.

I haven't yet mentioned the most interesting particular of all about our little gagea, and that is the peculiar colour of its sepals and petals. In common with all the other members of its genus, it has yellow flowers; and I have already tried to show on several occasions that yellow was the original colour of all blossoms—white, pink, and blue being successively later acquisitions. Moreover, gagea bears a very striking resemblance in hue and general appearance to several buttercups, especially to the lesser celandine (*Ranunculus ficaria*); and buttercups, as we know, are very primitive dicotyledons. Curiously enough, too, the petals and sepals are yellow on the inner (or exposed) side only; the outer side is green, so that the colour looks almost as if it had been daubed on with a brush upon one surface of a small green leaf. I have very little doubt that we see here a relic of an extremely early stage in the acquisition of colour by the petals of insect-fertilised flowers. And it is a significant fact that the other primitive genus of lilies, Tofieldia, has likewise greenish-yellow blossoms. Gagea is mainly impregnated by bees and flies. It seems to increase for the most part, however, by means of the bulbs, each old bulb producing two new ones in the course of every season, one on either side. These two bulbs are the store-houses in which the old plant lays by material for the flowering of its two successors in the following spring. Perhaps this practical comparative neglect of true reproduction by fertilised seeds, and substitution of the essentially non-reproductive method of increase by means of bulbs, may account for the numerous early characteristics displayed by gagea; for in reality each bulb is not a new plant, formed by genetic union between two old ones, but merely a bud from the old plant, springing afresh just as a cutting or sucker might do. Thus many existing gageas may really be parts of the very same plant that flourished innumerable generations since, a contingency which would bring them far nearer the original ancestor than other lilies which have been almost yearly reproduced from seed for countless ages.

NOTE ON FLYING-MACHINES.

IN all ages there have been thoughtful men who have looked with envy on the flying powers of birds, and have asked themselves the question whether man—the "unfeathered biped" of Plato—might not rival the feathered tribe even in their natural element. Hatton Turnor, in his "Astra Castra," asserts even that King David had such thoughts in his mind when he said, "Oh, that I had wings like a dove, for then would I flee away and be at rest." Without going quite so far, we think it may safely be asserted that few men who have watched the movements of birds in the air have not felt that the possession of such powers of aërial locomotion would be an enviable thing. Those who have taken part in balloon ascents speak of the strange feeling of exhilaration with which they see the things of earth diminishing beneath them. But if this feeling is experienced by those who, though raised above the earth, are yet not free to direct their motions according to their wish, how largely would the pleasure of aërostation be enhanced could the aëronaut direct his flight as freely as the birds of the air. Now soaring high above the clouds, now skimming the surface of the earth, the flying man would enjoy sensations which could almost be worth purchasing at the risk of breaking his neck.

Old as the problem of flight is, it is only within the last few years that its conditions have been thoroughly understood, and the practicability of its solution evidenced. By flight, it must be understood we refer wholly to the power of winging a way at will through the air—not to the mere power of rising above the earth. It seems to have been proved beyond all possibility of doubt that no contrivance founded on the principle of the balloon can possibly avail to enable man to travel at will through the air. The enormous volume which must be given to the balloon in order that its buoyancy may suffice to raise it safely with its living freight into the air, renders it so unwieldy that it is the sport of even the gentlest air-currents. Even in perfectly calm weather it has been found impossible, even by the most ingenious contrivances which could be devised for the purpose, to urge a balloon with moderate speed in any required direction.

In fact, the careful consideration of the subject has shown that mere lightness is far from being a desideratum in a flying-machine. M. Nadar aptly suggested the true difficulty which lies in the way of aërial navigation by means of balloons, in his description of a circumstance which fell under his notice in the streets of Paris. A workman on the roof of a house let fall a sponge, and called on one of his fellows to throw it up to him. Now, says M. Nadar, the man was too clever to fall into the mistake which so many aëronauts have made, of supposing that the lighter an object the better adapted it was for flight through the air. He knew that the light sponge could never be thrown to the roof of the house. So, what does he do? He first wets the sponge, and when, by this means, he had rendered it heavy, he was enabled to throw it to his companion.

Our first step, then, towards the solution of the problem of flying, consists in the discovery that weight—or at the least a certain proportion between weight and surface—is absolutely essential when something beyond mere ballooning is in question. But we must not fall into the mistake which M. Nadar made, of supposing that weight is in itself an aid to flight. We must remember that the sponge thrown up by the workman was under the influence of a force which was in reality derived from the resistance of the solid earth on which the workman stood. It would be as reasonable to urge that a cannon-ball was the model of what a flying-machine should be, because, propelled from a Whitworth gun, it traverses five or six miles before reaching the ground. Strictly confining our deductions to what is really proved by Nadar's illustrative anecdote, we say that directive power can only be given to an aërial machine which is not so buoyant as to be the sport of every wind that blows. A contrivance like the balloon, which requires that a surface of hundreds of square feet should be exposed to the air, can never, we see, be available for more than mere floatation.

It may be questioned, indeed, whether any modern invention has proved more unfavourable to the science of aërial locomotion than that of the balloon. Many ingenious flying machines had been invented before the time of Montgolfier; and in some of these we see signs of an appreciation of the real difficulties which attend the problem of artificial flight. But so soon as Montgolfier had exhibited the powers of rarefied air, men gave up for awhile the notion of attempting to fly by the aid of machinery. And the discovery that by means of hydrogen gas a

balloon might be made to float in such a way as to be a much safer conveyance than the fire-balloon, induced men of science to turn their attention to the improvement of balloons as the likeliest mode of solving the problem of aërial navigation. Thus it happened that the first half of the present century, though adorned by so many important discoveries in other branches of mechanics, was wholly unfruitful as respects the long-vexed question of the possibility of flying. Of late years, however, the subject has been taken up with renewed vigour and with fair promising results.

As regards old attempts to solve the problem of aërial navigation, we may mention—passing over the fabulous story of Dædalus and Icarus—the automaton bird constructed by Archytas of Tarentum, as in all probability the first successful attempt to construct a flying-machine. There seems no reason to doubt the truth of the narrative handed down to us respecting the labours of Archytas. All that Aulus Gellius mentions is that the Tarentine constructed the figure of a dove, "so contrived as by a certain mechanical art and power to fly; so nicely was it balanced by weights, and put in motion by hidden and enclosed air." On this the ingenious Cardon remarks justly, "there is no reason why such a machine should not be put in motion, especially by a favourable breeze. The lightness of the body would contribute to this result; as would the largeness of the wings and the strength of the wheels; and probably the dove could take its flight in a certain fashion, but with a wavering motion like the flickering of a lamp. Thus, it would sometimes mount upwards spontaneously, flutter its wings, then leave off suddenly and fall—its motive power being unequal to its weight."

But the attempt to attach wings to the human frame, so that man might emulate the birds, is one which has had more advocates than the plan of constructing automatous machines. In the reign of Edward the Confessor, an English monk, having attached wings in an ingenious manner to his limbs, leaped from a church tower into the air, and succeeded in covering a distance of 220 yards before reaching the ground. The flight was a daring one, and similar attempts have not often had so satisfactory a result. An Italian monk, who exhibited his powers of flight before James III. of Scotland, fell to the ground with such force as to break his thigh. And Allard, the rope-dancer, who attempted a similar exploit in the reign of Louis XIV. of France, was equally unfortunate.

Indeed, attempts of this sort have been so uniformly unsuccessful—for even the Saxon monk only managed to attain a limited distance—that the idea has come to be entertained that it is perfectly futile for man to attempt to fly by means of his own unaided powers. Those who have believed in the possibility of flight have fixed their hopes rather on the construction of large aërial ships, propelled by adequate machinery, than on man's power of imitating the flight of birds. The ingenious mathematician Borelli attempted to demonstrate the impracticability of human flight. He exhibited the striking contrast which exists between the pectoral muscles of birds and those of man. On either side of the breast-bone of the bird there are masses of muscle whose energy is wholly efficient in working the wings. But the corresponding muscles in man have scarcely any power whatever. Let any one contract his shoulders and notice how the muscles over the chest take part in producing the movement; their action, he will find, is altogether wanting in energy.

But it needed no mathematician to show us that if man is ever to fly, he must not attempt to imitate directly the action of a bird. As artificial appendages are absolutely necessary, it is obviously in man's power so to choose the arrangement and adaptation of these appendages, that in using them his limbs will work in the manner which best suits them. Since in upward and downward action man's arm is weak—as any one will find who tries to beat the air by such action for only a few minutes—it is clear that the mere flapping of wings attached to the arms cannot possibly avail to enable man to fly, however ingeniously those wings may be devised. On the other hand, the pulling power of the human arm is considerable, and such an action as that used in rowing can be maintained for hours without exhausting the frame. Hence this action is one which may be applied, if only suitable contrivances be devised, to aid in propelling the body through the air. Again, the legs of a bird are useless so far as flight is concerned, but there is no reason why man, in attempting to fly, should not make use of his legs as well as his arms. In walking or running, the legs exert a large amount of power in a manner which does not quickly weary the frame. Hence, in applying the action of the legs to aid in propelling the body through the air, the mechanician must devise such contrivances as shall call this customary action into play. If the full power of the arms and legs can be so applied to ingeniously-arranged mechanism as to work wings more or less resembling those of a bird, there is little reason for doubting man's power of sustaining himself in the air, and even travelling with great rapidity through it. Probably it will be much easier for him to sustain himself while travelling rapidly onwards, than while hovering over the same spot.

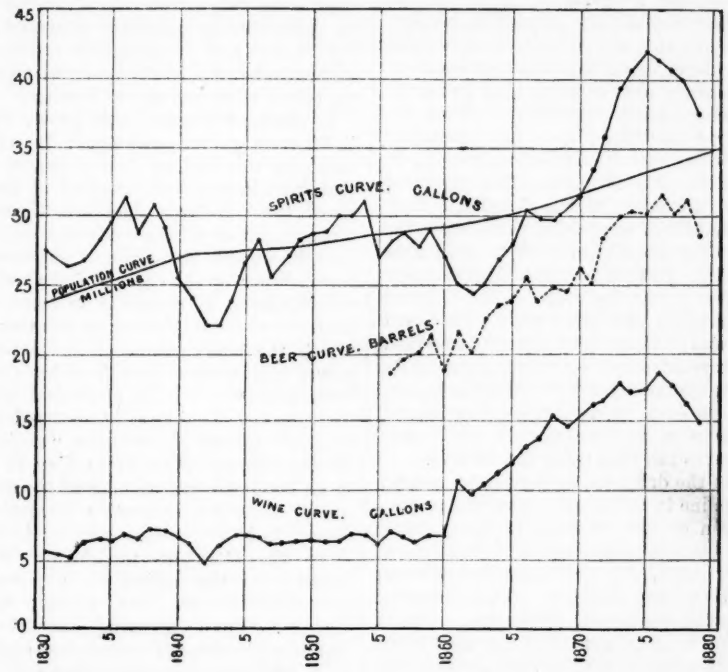
The Matrix of the Diamond.—Until the South African mines were discovered, the diamond was always found in sands and gravels, different from the mineral in which it was believed to be formed. At Griqualand West, however, the consolidated eruptive mud of the mines was believed by some to be the true matrix of the diamond; but opinions differed on the question, and arguments were found on both sides. M. Chaper, a French geologist, has, however, during a scientific mission to Hindustan, succeeded in finding the diamond in its mother rock. At Naizam, near Bellary, in the Madras Presidency, M. Chaper has found the diamond in a matrix of rose pegmatite, where it is associated with corundum. The tract of country is almost denuded of trees, bare and rocky, and the rains wasting the rocks, every year expose fresh diamonds in the soil. The rock is traversed by veins of feldspar and epidotiferous quartz. Here the diamond is always found, associated with epidotiferous rose pegmatite. The diamond crystals observed are octahedral, but less distinct in line than the stones of South Africa, which seem to have been formed in a freer matrix. It follows from M. Chaper's discovery that diamonds may exist in all rocks arising from the destruction or erosion of pegmatite—for example, in quartzites with or without mica, clays, pudding-stones, &c. —*Engineering.*

A New Illuminant.—Lieutenant Diek, of the Russian Army, is said to have discovered a new illuminating substance which is capable of imparting luminous properties to objects to which it is applied. It is in the form of a powder, and of three colours—green, yellow, and violet, the latter being the most powerful. Water in a glass vessel is by this means converted into an illuminating fluid. In a lecture recently delivered by the inventor at the Nicolai Engineering Academy, at St. Petersburg, he explained the application of the substance to military and industrial mining operations. The illuminating power lasts for eight hours, and the powder must then be renewed. The German Government is said to have been lately making experiments with Lieutenant Diek's invention.

HOW WE DRINK.*

IN studying the drunkenness of the last fifty years, we are not bound to take the word of any individual as to the comparative dissoluteness of a particular class of people. We are in a position to say with precision when drunkenness has been most indulged in by the drinking class, and when most eschewed. We live in an age of statistics, and data on this subject are rigorously collected for revenue purposes. It appears then that, notwithstanding temperance advocacy, drunkenness has increased during the last fifty years. It is matter for congratulation, however, that this increase is for the most part only the increase due to a larger population; in other words, although the total consumption of intoxicants is much greater now than it was—say, in 1830, the individual consumption remains very nearly the same. We have all the data for an exact study of the subject in the elaborate and formidable array of figures collected by the Rev. Dawson Burns, in a paper on "Fifty Years' Consumption of Intoxicating Liquors in the United Kingdom (1830-79)."† We prefer to present the information in the form of curves, as the reader can then see with ease and at a glance, the fluctuations of consumption in the half-century. To the unscientific reader, however, some explanation is necessary as to the way in which such curves are constructed. In the illustration a series of perpendicular lines (ordinates) represent the years from 1830 to 1881, and a series of horizontal lines (abscissæ) represent millions, from twenty millions at the bottom to forty-five millions at the top. Now, let us say that in 1830, 27¾ million gallons of spirits were consumed in the United Kingdom, then a point on the 1830 line, and proportionately between the twenty-seven and twenty-eight million lines, marks the fact. Similarly, if in 1831 the consumption were 26¾ million gallons, a point on the 1831 line and between the twenty-six and twenty-seven million lines would represent it. By joining these two points we obtain the first portion of the drink curve relating to the consumption of spirits in the United Kingdom in 1830 and 1831. In the figure the general form of this spirit curve is given for comparison with the beer and wine curves below it. The comparison is a very instructive one.

Looking at the wine curve it will be observed that the consumption slightly fluctuated above and below six million gallons per annum until 1860. Hitherto it had been the beverage of the rich; alternations of good and bad trade had very little affected the consumption of it,



but the great leap in the curve from 1860 to 1861 marks the era of the introduction of cheap and nasty wines into this country; and thenceforward, under the ægis of free trade, the wine curve showed itself more sensitive, and followed the general trend of the beer and spirits curves.

Beer is the liquor of the poorer class of drinkers. It is drunk in such quantities in the United Kingdom that for the convenience of comparison we have plotted the curve for millions of barrels instead of millions of gallons. So far as the curve goes, data being wanting for its construction prior to 1856, it follows the general direction of the other curves. It will be noted, however, that from whatever cause or causes the fluctuations in these curves arise, the spirits curve is the most sensitive of the three. It reached its highest point in 1875 before the others, and, as the most susceptible of the three, began its downward course the first. We regard it as *the* drink curve *pa*·

* From Mr. W. Ackroyd's exceedingly interesting "History and Science of Drinking." (Simpkin, Marshall, & Co., London.)

† The National Temperance League's Annual for 1881, pp. 38-45.

excellence, showing as it does in unmistakable manner whether the rate of drinking is a high or a low one, and whether it is on the increase or on the decrease. We may, therefore, now turn our attention to it alone.

If the population curve, showing the increase in population from 1831 to 1881, be plotted down along with the drink curve, it will be seen that they both take the same general upward direction; in other words, that the home consumption of spirits in the United Kingdom has increased with the population, and at about the same proportionate rate. It will be further observed that the two curves cross each other several times in the course of the fifty years. On each of these occasions the individual consumption was the same, viz., one gallon of spirits per head per annum.

The most remarkable thing about the drink curve is its irregularity, its succession of peaks and valleys contrasting markedly with the gently sinuous population curve, and it is a matter of some importance to our subject for us to inquire into the causes of this irregularity. It is perhaps not possible to formulate any definite proposition respecting those causes. We find that the curve descends during bad times and ascends during good times, so that commercial depression and prosperity are two important factors in producing the irregularities of the drink curve. Thus, for example, the drink curve has been below the population curve during periods of commercial depression, as *e.g.*, in 1842-1843 and 1859-1870. The former was the period of plug-drawing riots, and the latter of the American War, and of the failure of joint-stock companies. Turning to the last rise in the curve, we know that in 1870 to 1871 commerce was recovering from years of reverses. The next few years were years of great prosperity. In 1871, 1872, and 1873 the curve went upwards with great speed; the ascent was continued in 1874 and 1875, though at a diminished rate. During the three former years money was plentiful among the people, and the drinking section spent it recklessly in liquors, and continued to do so even up to 1875. The tide of depression appears, however, to have already set in, and since then the drink curve has been going downwards.

The continued fall of the drink curve in recent years, or, in other words, the decline in the drink revenue, has commanded much attention of late because of its political importance. It has been regarded as an indication of reformation of English habits. We trust that it may be so. There have certainly been other causes at work to make the decline continuous besides commercial depression. One of no small importance has been the spread of education since the passing of the Education Act of 1870. Another has been the substitution of suitable places of resort, such as coffee taverns and working men's clubs, for beershops and liquor shops. And last, though not least, there has been the persistent advocacy of temperance reformers. The great work which has been accomplished by the temperance societies of the United Kingdom has probably been of a checking nature; they appear to have been highly successful in preventing the contagion of drunkenness from spreading as it otherwise might have done, so that after fifty years of work the consumption of spirits per head per annum is little more than it was when they started. How it might have developed is illustrated by the example of Belgium, where the consumption of liquors per head per annum has increased to a frightful extent, and in 1882 had the alarming quantity of seventy pints! England is therefore not the most drunken of nations, thanks to the checking agencies which have been at work for a great number of years. We cannot hide from ourselves, however, the great probability there is that the drink curve will take another decided turn upwards on the return of thoroughly prosperous times, but it is the wish of all who are well acquainted with the significance of this upward movement that on the return of genuine prosperity there may be no corresponding change in the drink curve.

THE UNIVERSE OF SUNS.

By Richard A. Proctor.

(*Continued from p.* 188.)

Herschel then proceeds from class to class of well-marked clusters, to the most compressed and presumably the most distant clusters, and thence to globular nebulæ which are probably sidereal, but are ambiguous on account of their faintness or distance. He remarks that precisely as "in passing from faint nebulosity to the suspected sidereal condition we cannot avoid meeting with ambiguous objects," so a similar "critical situation will again occur, when from the distinctly sidereal appearance we endeavour to penetrate gradually further into space." The former sort of ambiguity results from the really ambiguous condition of the observed objects, the latter from the effects of an increase of distance.

In closing this remarkable paper, Sir W. Herschel (*then in his seventy-sixth year*) says: The extended views I have taken in this and my former papers, of the various parts that enter into the construction of the heavens, have prepared the way for a final investigation of the universal arrangement of all these celestial bodies in space; but as I am still engaged in a series of observations for ascertaining a scale whereby the extent of the universe, so far as it is possible for us to penetrate in space, may be fathomed, I shall conclude this paper by pointing out some inferences which the continuation of the action of the clustering power enables us to draw from the observations that have been given.* . . . *It is evident that if ever the Milky Way consisted of equally scattered stars, it does so no longer*," and our observations "*authorise us to anticipate the breaking up of the Milky Way, in all its minute parts*, as an inevitable consequence of *the clustering power arising out of those preponderating attractions which have been shewn to be everywhere existing in its compass.*" "Now, since the stars of the Milky Way are permanently exposed to the action of a power whereby they are irresistibly drawn into groups, we may be certain that from mere clustering stars they will be gradually compressed through successive stages of accumulation, ... till they come up to what may be called the ripening period of the globular form, and total insulation; from which it is evident that the Milky Way must be finally broken up and cease to be a stratum of scattered stars.† We may also draw a very important additional conclusion from the gradual dissolution of the Milky Way; for the state into which the incessant action of the clustering power has brought it at present, is a kind of chronometer that may be used to measure the time of its past and future existence; and although we do not know the rate of going of this mysterious chronometer, it is nevertheless certain, that *since the breaking up of the parts of the Milky Way affords a proof that it cannot last for ever, it equally bears witness that its past duration cannot be admitted to be infinite.*"

* The omitted passages are descriptive portions relating to the Milky Way, and have no special bearing on our subject.

† Herschel has already shown that it no longer consists of *equally* scattered stars; so that this sentence should not be misinterpreted to imply that he still retained the idea that the Milky Way is constituted like the part of the heavens forming our constellations.

I conceive that as the theory of 1785 marks a certain stage in Herschel's progress towards the interpretation of the sidereal universe, so the ideas enunciated in 1811 and 1814 mark another stage, which is as definitely distinguished from the subsequent work of Herschel as from the work resulting in the theory of 1785. We have in those two papers a second grand sketch of the universe as Herschel now understood its features. The sketch includes celestial objects of all known forms from the faintest nebulous haze to the most condensed star-clusters. It constitutes, to my view, notwithstanding Struve's dictum to the contrary,* a theory of the universe even more complete and precise than the theory of 1785.

I find it difficult to indicate the opinion which according to my judgment should be formed of the memoirs of 1817, 1818. These pages are full of striking passages, full of the clearest evidences of power. They have been admired and justly admired for the grandeur of the conceptions enunciated by the great astronomer. "*Heureux mortel*," exclaims Struve, "*heureux mortel que fut Herschel, de jouir à l'age de* 80 *ans d'une pénétration de l'esprit, et d'une clarté du jugement qui le firent composer les deux derniers mémoires, remplis d'une spéculation sublime et profonde!*"

While sharing to the full this sentiment of admiration for the noble papers contributed by Herschel in his 79th and 80th years, to the science he had served so earnestly and so long, it appears to me that they exhibit unmistakable traces of failing powers. It is with reluctance I touch thus on a point which I would have preferred to leave untouched did truthful dealing with my subject permit. Not indeed that it can be regarded as in any way injurious to Herschel's memory to point out that his powers were less in his 80th year than they had been a few years earlier; but that if it were possible, one would avoid to dwell on his less perfect work. It is, however, impossible to leave unnoticed theoretical considerations which have been over and over again classed with the finest generalisations of the great astronomer.

In the papers of 1817 and 1818 Herschel undertakes the consideration of the sidereal universe under an entirely new aspect. In 1785 he had been guided chiefly by the numerical relations observable among the stars in different parts of the heavens; and he had inferred from such relations the dimensions and proportions of the stellar system. In 1811 and 1814 he based his conclusions upon the aspect of the celestial objects and of various regions of the heavens,—inferring thence not merely the laws according to which the stars are distributed throughout space, but the processes by which during long past ages they have reached their present condition, as well as those which in future ages they will probably undergo. In 1817 and 1818, he took as the basis of his researches the quantity of light received from individual stars and from star groupings of various orders and endeavoured to infer thence the actual profundity of the celestial depths. The idea was not less magnificent than either of those conceptions on which he had based his former researches, nor was the work of observation carried on with less vigour and energy; but the elasticity of mind which Herschel had displayed in dealing with his observations on former occasions seems here in great degree wanting.

* "*On peut demander*," says Struve, "*pourquoi les astronomes ont-ils maintenu généralement l'ancien système sur la voie lactée, énoncé en* 1785, *quoiqu'il eût été entierèment abandonné par l'auteur lui-même, comme nous l'avons démontré. Je crois qu'il faut en chercher l'explication dans deux circonstances. C'était un système entier, imposant par la hardiesse et la précision géométrique de sa construction, et que l'auteur n'avait jamais révoqué dans sa totalité. Dans ses traités publiés depuis* 1802, *on ne rencontre que des vues partielles, mais qui suffisent, en les comparant entre elles, à comprendre l'idée finale du grand astronome.*" It appears to me after a careful study of Struve's reasoning,—that he in the first place overestimates the precision of the theory of 1785, in the second that he under-estimates the completeness of the theory of 1811-1814, and lastly that he fails to notice sufficiently the circumstance that the papers of 1817, 1818 are distinct in all respects from Herschel's former work.

TRICYCLES IN 1884.

By John Browning,

Chairman of the London Tricycle Club.

THE TRIAL OF THE "STERLING."

My readers have kindly shown so much interest in the article I wrote a short time since on "Trying Tricycles" that I am induced to devote an article to a fuller account of the manner in which I have just been testing one of the special machines recently completed for me, and exhibited by the ingenious maker, Mr. Burdess, at the Floral Hall.

Having got the light "Sterling" from the Stanley Show all right, I at once spent a few hours in a preliminary trial of the machine. The roads were far from perfect; being heavy with recent rain, which had been falling for nearly two days previously, the narrow tyres in many places sank into them.

The best test I have found for the light running of a machine is that it shall run swiftly down a very moderate incline without working the pedals. Judged by this standard, the light "Sterling" beats any machine I have ever ridden. Again, in riding up hill, I tested it on the stiffest hill near my place, known as "Robinhood Hill." I found the machine ran so easily that I actually got half way up it, without feeling any strain, with the speed-gear on, that is, the machine running at about 50 in. As soon as I felt anything like an unpleasant resistance, I back-pedalled, thus bringing the power-gearing into action, and rolled up the rest of the hill without exerting myself in the least. Now, I have only ridden up this hill once before on my light "Humber," which weighs 15 lb. less than the "Sterling," and is geared 2 in. lower than it, and I thought that the machine would break under the strain I had to put on it, and I decided never to ride up the hill again. I should not have tried it on this machine had not my friend, Mr. Grace, told me that, being a single driver, he thought I should drive it round on the hill-side, without being able to get up it.

I could only suggest one improvement to the machine, viz., that owing to its running so lightly it might be geared 5 in. more, both for power and speed; but what would be better and cost less, would be for the machine to have a crank with 1 in. less throw—5 in. instead of 6 in. This would be a great advantage in a long day's journey, as it is found that a 6-in. throw is too long for continuous work. I shall try to get such a crank made 1-16th less in diameter, with ball rat-trap racing pedals; this will reduce the weight of the machine about 3 lb., without decreasing its strength.

I found the stearing-gear rather stiff in action; but that, I hope, will get easier with a little use.

I have made two further trials of what I will call, to distinguish the machine, the "Phantom Two-speed Sterling," under the following circumstances. Having asked a friend to go with me for a day's ride on the machine, he expressed a doubt whether so light a machine would hold together for a day if we had a hard ride. To test this, I took the machine out and rode it up and down hills for

about six miles as hard as I could ride it over the worst and roughest macadam in the hamlet of Penge, and there is not a quarter of a mile of this granite to be found but what is a disgrace to the parish, even in the best parts of it. The roads were dry and hard, in which condition granite is the most trying.

Having stood this test successfully, I then rode the machine against a 6-inch kerb twice, the second time so hard that I nearly threw myself out of the saddle, though I leant well back in anticipation of the shock. I dented the rims, but the machine remained otherwise uninjured. Another friend suggested to me, after hearing this, "Well, the machine may go very well in dry weather and on good roads (mind, I had been testing it exclusively on bad ones), but," said he, "as soon as we have rain and wet roads, then it will slip, and you will be able to do next to nothing with it."

The day after this, in the morning the roads looked as if it had rained nearly all night, and after allowing them to dry only two or three hours, in which condition they are the heaviest, becoming on clay soils pasty, I took out an excellent double-driver, on which I have done some good hard days' work, knowing well its capabilities, and rode it exclusively over hills from Penge to the top of the Crystal Palace hill, up the Crystal Palace Park-road. I found this excessively hard work—so hard that I thought I should scarcely manage it. Then I rode back again, and without a moment's delay took out the light "Sterling" and rode it over the same ground. This was, of course, unfair to the "Sterling," as I had already tired myself—in fact I was nearly done up; yet I rode it with the most perfect ease. I do not say the work was not half as hard; it gave me the impression of not being one-quarter as hard, and though the "Sterling" was about 12 lb. lighter than the double-driver, it ran down many parts of the hill where it was not so steep without driving, while the heavier machine required driving all the way. I have now tested the machine not only severely, but unfairly in every way I can devise, and am perfectly satisfied with it except in two respects—that I wish to have a shorter crank and ball pedals.

I should not wish it to be thought that I am praising this "Sterling" unduly, but it is no exaggeration to say that, with the low-speed gearing, it is possible to rest oneself while riding up a tolerably steep hill. At the same time, I must add, that if any one wishes to ride as fast as he can, it is not the machine he should choose; for if he desires to ride at the rate of from twelve to fourteen miles an hour on a common road, the machine will not suit him; but if he will only exercise common care in riding down hills, and be satisfied with covering seven or eight miles an hour on up and down roads *easily*, then I doubt if any other machine in the market will answer his purpose equally well.

The weight of this machine with two-speed gearing is about 65 lb. The power-gearing runs as 28 in., and the speed-gearing at a little over 49 in.; both are rather too low for so light a machine. They might run from 5 in. to 6 in. higher with advantage. The wheels are 37 in. diameter only, and it is due only to the small size of these that it has been possible for the maker to produce a machine so light in weight. I wish to repeat that I attach no value to small wheels, beyond this, that their adoption enables us to make the tricycle lighter and stronger. At present, with 48-in. driving-wheels and 18 in. steering-wheels, our driving-wheels are too large and our steering-wheels are too small.

Again, our rubber tyres are too small. Frequently, manufacturers put a smaller rim and tyre on the steering-wheel than on the driving-wheels; the very reverse should be done. The rim and tyre of the small wheel should be at least one-eighth larger than those on the driving-wheels. I shall favour those machines in future which have the driving-wheels smaller and the steering-wheels larger, and in which the weight of the rider is more distributed over the three wheels, instead of being placed nearly all on the driving-wheels, and only barely enough placed on the steering-wheel to enable the rider to guide the machine.

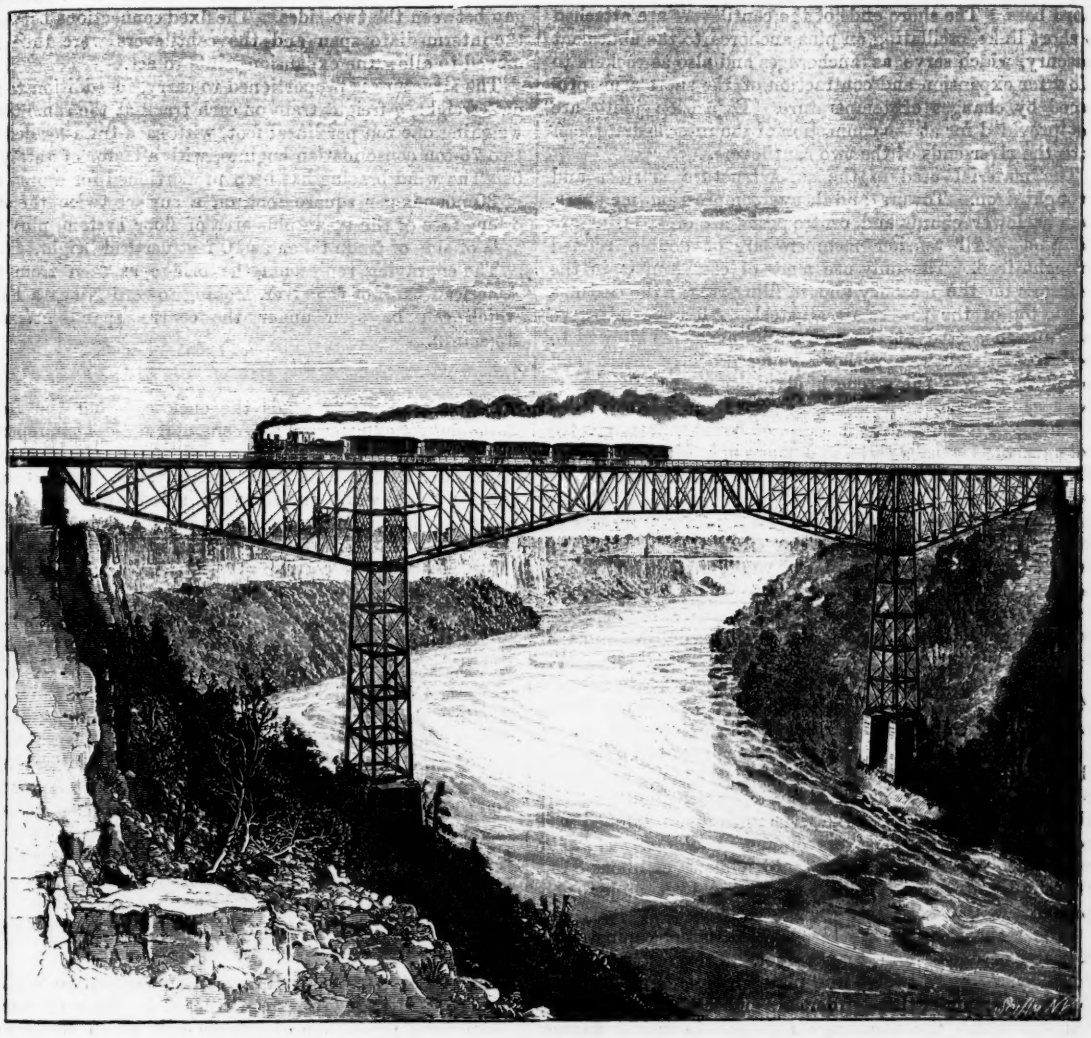
An Elephant that Reads.—Louis E. Cook, agent of Cole's Circus, tells a remarkable story that illustrates the elephant's wonderful capacity for receiving and retaining impressions, and at the same time, shows the great possibilities still offered in the direction of educating the pachyderm. "Our trainer, George Conklin," said Mr. Cook, "while in New York last winter, had several conversations with an eminent zoologist, who, among other theories, advanced this: That the elephant could be taught to read written characters. He explained that the education of the great beast had gone even further than mere feats of memory, either in the matter of language, or judging of shapes and forms. It had been trained to do work of many kinds in the East, such as piling lumber in systematical columns, and even setting the heavy stones in masonry so that expert workmen found it seldom necessary to make any changes in their position. The cunning of the elephant was well known, for the trained monster was often used to lure his wild brethren into snares, and frequently assisted in throwing and holding down the captive until the chains were placed upon him. The zoologist used other arguments of the same kind, and Conklin at last determined to make the attempt, and determine the possibility of teaching the elephant how to read. He selected 'Rajah,' a 15-year-older, for the experiment. He got a blackboard two feet long and eight inches wide, on which to inscribe the letters. He did not begin, however, by teaching the animal the alphabet. He did not seem to want to make the experiment in that way, as it might be too tedious; but, as you know, ring or trained elephants know all the words of command spoken by the trainer. They will stop when he cries 'halt,' move on when he says 'march,' run at the order to 'double-quick,' and indeed obey every word spoken to them. Well, Conklin hit upon this plan. He took 'Rajah' into the ring at least once every day, and writing the word 'march' in Roman characters about five or six inches long on the board, placed it before the animal's eyes, and after allowing him to scan it, then, pointing to the white letters, shouted the order 'march,' which, of course, was complied with. He found by writing the letters while the board was held before the elephant was a surer way of attracting the animal's attention to the characters, so he now writes in this way. Rajah soon grew accustomed to the board and the letters, and now very seldom makes a mistake when a written command is presented to him. He will march the moment the last letter is finished, halt when the trainer shows him the word, and, indeed, recognises every inscription of this kind Conklin places on the board. The elephant will not be introduced into the ring in this new act until next season, by which time the trainer thinks it possible to educate the whole herd in reading, so that the words of command may be given in writing on a large blackboard. Having succeeded so well in teaching "Rajah" to read words, he will now try to advance backward by teaching him the alphabet, and I myself think it possible that the elephant, which is quick and intelligent, may be taught by means of lettered blocks to spell the words that he is familiar with in the ring."—*New Orleans Times Democrat.*

CANTILEVER BRIDGE OVER NIAGARA.

THIS double track railroad bridge, completed within the past few days, was designed to connect the New York Central and Michigan Central Railroads. It is located about 330 ft. above the old railroad suspension bridge, spanning a chasm 870 ft. wide between the bluffs and over 200 ft. deep. The banks of the river are formed of masses of broken rocks and immense boulders reaching up to within about 60 ft. of the level land.

in charge of the work, and Edmund Hayes, engineer of the Central Bridge Works.

The structure consists of two immense steel towers, 132 ft. 6½ in. high, resting on stone piers 39 ft. high. Each of these towers supports a cantilever 395 ft. $2\frac{5}{16}$ in. long. One end of each tower rests upon an abutment at the edge of the bluff, while the other end extends out over the river. The shore ends of the cantilevers are anchored to the abutment masonry or anchorage piers, and both river arms are connected by an intermediate span of 120 ft.



As the foaming rapids at this point rendered it impossible to build piers in the river or erect temporary supports, it was necessary to design a structure which could be erected without such false work; to attain this end a bridge of the cantilever type was adopted which would be self-supporting during erection. The principle of the cantilever is that of a beam supported at or near its centre, with arms extending both ways, one arm being held down by an anchorage or counterweight so that the load on the overhanging arm produces an uplifting force in the opposite end which is resisted by the counterweight. The designs of this structure were worked out jointly by C. C. Schneider, chief engineer

which is suspended from the extreme ends of the river arms. The total length of the bridge proper is 910 ft. $4\frac{5}{8}$ in. between the centres of the anchorage piers, the clear span between towers being 470 ft. The height from surface of water to base of rail is 239 ft.

The towers are braced steel structures, containing four columns each, which are made up of plates and angles riveted together, braced with horizontal struts and tie-rods. The batter of the columns at right angles to the centre line of the bridge is 1 in 8, and parallel to the centre line 1 in 24.

The trusses are two in number, 28 ft. apart between

centres; the various members being connected with steel pins, 7½ in., 6¾ in., and 5⅜ in. in diameter, turned accurately so as to fit the bored pin-holes within 1-64th of an inch. The depth of the cantilever trusses over the towers is 56 ft., and at the shore ends 21 ft., and at the river ends 26 ft. The lower chords and centreposts are made of plates and angles riveted together and latticed, the intermediate posts being of 12 by 15-in. channels, latticed. The upper chords of the cantilevers are 8-in. eye bars, the shore arm having a compression member 18 in. deep composed of plates and angles packed between the chord bars. The shore ends of the cantilevers are attached to short links, oscillating on pins anchored to the abutment masonry, which serve as anchorages and also as rockers to allow for expansion and contraction of the shore arms produced by changes of temperature. Expansion joints are also provided for at the connection of the intermediate span with the river ends of the two cantilevers.

The material used in the superstructure is steel and wrought iron. Towers and heavy compression members, such as lower chords and centre posts, are of steel, as are all pins. All tension members are of double refined wrought iron. The only use made of cast iron is in the pedestals on the masonry and in filing rings; the castings at the top of the towers are all steel. All materials were carefully inspected at the mills, and none was allowed to go into the structure without being properly tested and found to possess the strength, elasticity, &c., called for by the specifications.

The floor beams are 4 ft. deep, of wrought iron, riveted between the vertical posts, and made of plates and angles. There are four lines of longitudinal stringers, resting on top of the floor beams; these stringers are plate girders 2½ ft. deep. The track consists of 9 in. by 9 in. ties of white oak, spaced 18 in. between centres, every other tie projecting to support a plank walk and hand-railing, making the width of the floor 32 ft. The guard timbers are 8 in. by 8 in. of white oak. The hand-railing consists of cast-iron posts, 6 ft. apart, and four longitudinal lines of 1¼ in. gas piping.

All masonry is built of Queenstown limestone, in courses of 2 ft. rise. The piers supporting the towers are 12 ft. square under coping, and have a batter of one-half in. to the foot; each pair of piers is connected by a wall 3 ft. 9 in. thick on top, and battering the same as the piers. These piers are on foundations made by excavating and blasting the rock on the banks of the river until a suitable bed was reached, consisting of layers of huge boulders. The pits were filled with beton Coignet to a depth of about 8 ft., thereby forming beton blocks of 20 by 45 ft. under each pair of piers.

The anchorage piers are 11 by 37½ ft. under coping, with a batter of one-half in. to the foot. They rest on a platform consisting of twelve iron plate girders, 2½ ft. deep and 36 ft. long; under these girders are eighteen 15 in. I-beams, through which the anchorage rods pass in such a manner as to distribute the pressure over the entire mass of masonry. Each anchorage pier contains 460 cubic yards of masonry, weighing 2,000,000 pounds. As the maximum uplifting force from the cantilevers under the most unfavourable position of the load is only 678,000 pounds, it will be seen that this upward force is amply counter balanced.

One of the most interesting features of this important work is the erection of the river arms of the cantilevers. After the towers were built the shore arms of the cantilevers were erected on false work in the usual way; after the shore arms had been placed in position and anchored down to the anchorage piers, the river arms were built out from the towers toward the river, one panel or section at a time, by means of great travelling derricks designed and constructed specially for the purpose and provided with steam power. After one panel had been built and its bracing adjusted, the traveller was moved forward and another panel erected. Thus the work progressed until the ends of the cantilevers were reached. The intermediate span of 120 feet was so designed, with bottom compression members, that it, too, could be built out from the river arms of the completed cantilevers until the middle panel was reached, which was accurately fitted to close the remaining gap between the two sides. The fixed connections between the intermediate span and the cantilevers were then removed to allow the expansion joints to act.

The structure is proportioned to carry, in addition to its own weight, a freight train on each track at the same time, weighing one ton per lineal foot, with each train headed by two 76-ton consolidation engines, with a factor of safety of 5. The wind bracing has been proportioned for a pressure of 30 pounds per square foot, on a surface twice the area of one face of the truss, plus area of floor system, plus the area of side of trade taken as 10 feet vertical height.

The engraving represents the bridge as seen from the American bank of the river, looking toward Niagara Falls, which can be seen under the centre span.—*Scientific American.*

A correspondent sends the enclosed from the *Derry Standard* for explanation:—A singular accident is reported to have happened in connection with the insulated electric rail on the Portrush Electric Tramway. A ploughman returning from work on Thursday stood upon the rail to mount his horse, and, on applying his hands to the back of the animal, the brute fell dead, while the man was uninjured, although the current of electricity must have passed through his body to the horse.

The Bureau Veritas has issued a list of the marine losses of the world for the past year. Summarised, it may be said that the net tonnage of the sailing-vessels of the world lost was 458,798, and that more than one-half of the vessels forming this tonnage were lost by stranding. British vessels gave nearly one-half of the loss; then followed American, Norwegian, German, Italian, in the order named, and others. Of steamers the losses were to the amount of 162,217 tons, five-eighths being British, and then following German, French, and American; and here again stranding is the cause of a large part of the loss—more than half in number. Most of the sailing-vessels that are lost are of wood; most of the steamers that are lost are of iron. This would seem to suggest that the oldest vessels of both sorts are those of which most are lost.

M. Cailletet, so well known in connection with the liquefaction of gases, has constructed an apparatus for the continuous production of intense cold, which consists of a closed steel cylinder containing a coil of copper pipe which projects from each end of the cylinder. Two copper tubes are also screwed into the cylinder, and one of these communicates with the mercurial piston pump already used by Cailletet, while the other receives the ethylene which has been compressed by the pump and cooled by methyl chloride. By this arrangement he forms a circuit in which the same quantity of condensed ethylene is repeatedly evaporated in the copper coil, producing intense cold, and then compressed again by the pump being sufficiently cooled with methyl chloride and ready for evaporation again. This process goes on as long as the sucking and compressing pumps are working.

Gossip.

It is probably scarce necessary to explain that the figures illustrating the safe-with-care and the safe-with or without-care forms of limelight illustration in last week's Gossip, are not pictures of any instruments actually in existence. The fact is I drew figures to be made up with type as here shown. But blocks were actually cut, and entirely novel

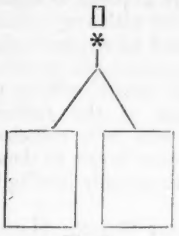


Fig. 1.

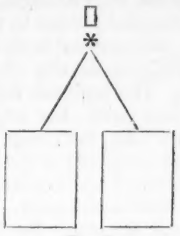


Fig. 2.

forms of lime-light apparatus were thus elaborated. The principle is the same however.

It is evident, from the comparatively thin audiences at the Memorial Hall—though nothing could be kindlier than their greeting—that the City in the evening is not a good place for scientific lectures.

The Editor reminds readers that he lectures on the 7th and 9th inst. at the Crystal Palace, the subjects being "The Life of Worlds" and "The Moon."

The *Globe* discusses the question whether the opinion of us indicated by the French saying "As original as an Englishman" is justified by British originality. The medicinal properties of a man who has been pronounced "a cure" may next be discussed.

One has only to take up the first average translation of a French work to come across multitudes of similar misapprehensions of the meaning of French words and phrases. I open at random, as I write, "John Bull and his Island," and the first sentence I read begins "That which," where the corresponding French sentence begins "*Ce qui.*" There is a considerable difference between the two expressions. For instance, when a Frenchman says, "*Ce qui me plait,*" he does not mean "*the* thing which pleases me," or "that which pleases me," but "a thing which pleases me."

Can anything be much more amusing than the way in which newspaper writers speak of the rowing in the University Boats? I learn from one account that Cambridge would be a good crew if some of the crew did not miss the beginning and if others could be persuaded to pull their weights; "seven" cannot keep time, and so puts "six" out; another rows too deep; the crew as a lot do a deal of splashing; it is far inferior to last year's crew (of which the same story was told, as of every crew since the races began); but it may improve. As for the Oxford crew, some accounts would suggest (to any one who did not know the real worth of these reports), that a clumsier set of oarsmen were never seen; yet their strength and "life" may save them, if they will but attend to newspaper hints; true, their stroke rows light, barely covering his blade, and there are others who unless watched will shirk their work; but though far inferior to last year's crew (as usual) the Oxford men are a promising lot. (Perhaps in ten years' time some of them will have learned how to row.) If these scribes knew anything of the way in which University crews are selected they would not write—perhaps—so much nonsense. Every man has his record, and has proved himself in many hard-fought contests a stalwart and skilful oarsman. The worst of the sixteen is the pride of his college first boat, and the worst oar in a fourth or fifth college boat at Cambridge or in a torpid at Oxford would scarcely ever display the gross faults of style, and would *never* display the laziness and want of pluck so complacently attributed to the picked oarsmen of the leading boats by ignorant reporters. One of these it was who a few years ago, seeing the Cambridge boat pass when a strong side wind brought the stroke side down, announced that all the men on the stroke side brought in their hands too low, the bow side showing as grievous a fault of the opposite kind! And of like worth are nine-tenths of their criticisms.

But the most preposterous mistake of all was made a few days back by a writer who said that with all the contradictory advice given them, the crews could hardly be expected to improve! As if a man in either boat was likely to pay the least attention to newspaper suggestions!

I have received a great number of communications in reference to the pregnant remarks of my esteemed correspondent "N. W." on the subject of scientific societies. The evil to which he referred, the election to such societies of men without scientific or literary standing, even it may be without scientific or literary attainments, is unquestionably an evil and a crying one. But I know not how it may be diminished. Examinations, as suggested by one correspondent, are in reality quite out of the question. The whole matter turns and must turn on the qualities of the members themselves of such societies, and thus the evil instead of being one which brings its own remedy is one which increases itself.

Still it may be well to point out to the genuine members—the really working members—of these societies, that they at least should refrain from the work of lowering the societies to which they belong by nominating those who are not the right sort of men for membership. I find some have positively the notion that in increasing the number of fellows or members they are increasing the weight and influence of their society. They may increase the balance at the society's bankers, but in all other respects a society is lowered when men are brought into it who are not capable of advancing the work for which it was started. The clause which all self-respecting societies and clubs introduce into their bye-laws, that none shall be nominated except on personal knowledge, becomes a mere dead letter, if personal knowledge be not understood to signify something more than mere personal acquaintanceship. No man should be nominated for any society of whom it may not be said that he is known to be interested in the purpose, and capable of advancing the work, for which the society was founded. Otherwise a society is almost as much degraded by its electoral system, as a body which elects men without even ascertaining that they desire election,—as in the case of my own election to the St. George's Chess Club which I cited some time ago.

But the matter may be viewed from the other side also. Men who think of joining a society should consider whether

they are really likely to prove efficient members, and whether they really have a right to put themselves forward for election. This should be so much a point of honour that even when election has been granted unsought a man should reflect before he accepts it. He should not, merely because elected, allow himself to be enrolled on the society's lists, unless he is satisfied that it is right and fitting he should be. If not so satisfied he may pay, if he will, whatever fees his election involves, and so avoid the unpleasantness of flinging back an unsought favour: but he should take the earliest opportunity of withdrawing.

In passing, I may note that so far as my own experience is concerned, even the paying of fees in such a case is undesirable. For I have recently learned from the Secretary of the St. George's Chess Club that *had I omitted that ceremony* an expression of regret for my undesired election would have been tendered me (somehow I regarded this as my due in any case), but that as I had paid their fees the Club is no longer responsible for that act of courtesy. But this may be simply Mr. Minchin's idiosyncrasy: after all it is a mere question of taste and breeding.

If a bad system of election to Societies is to be deprecated, much more may exception be taken to a system by which unsuitable officers are selected. It has been pointed out by our valued contributor, "F.R.A.S.," in a letter to a contemporary, that among the members of the Council of the Royal Astronomical Society are positively several who have contributed nothing to the proceedings of the Society *for four years!* They must surely have been elected by mistake, and without having been consulted; for to have remained so long without contributing to the Society's proceedings is practically equivalent to saying that either one does not or one cannot take any interest at all in the Society's work and purpose. I know at any rate that this has been the reason for my own failure to contribute for several years (since the internal squabbles began) to the Society's proceedings or to attend meetings. No one who so withdraws from a Society's work should be regarded as eligible to office of any sort whatever within the Society.

Reviews.

SOME BOOKS ON OUR TABLE.

George Birkbeck, the Pioneer of Popular Education. By J. G. Godard. (London: Bemrose & Sons. 1884.)—To the present generation Dr. Birkbeck represents but little more than the "*nominis umbra*" of which Lucan speaks. And yet, in the words of Mr. Godard's title, he may well be regarded as the pioneer of that education which is becoming daily more widely diffused among the masses. His latest biographer tells us how the quondam "Mechanics' (now Birkbeck) Institution" in Chancery-lane had its inception in lectures given to working men by George Birkbeck, at the time he was Professor of Physics in the Andersonian Institute—at present absurdly called the Andersonian University—in Glasgow; and gives the history of the struggles of what has now grown into a great educational establishment from the date when its earliest lectures were delivered in a chapel in Monkwell-street, through the erection of its own original proper house in Southampton-buildings, down to the date of the laying of the foundation-stone of the Birkbeck Literary and Scientific Institution by the Duke of Albany in 1883. It is interesting and instructive to follow the Institution through its struggles, and to learn how successfully it surmounted the difficulties it had to face both from pecuniary troubles within and violent opposition from without. As a record of the educational movement which originated during the first quarter of the present century, Mr. Godard's book will repay perusal.

German Conversation Grammar. By I. Sydon. (London: W. Kent & Co. 1883.)—As far as a foreign language can be self-taught, we are disposed to regard Herr Sydon's manual for use to that end with very considerable favour. His method is simple, and his examples chosen in a way likely to develop the conversational powers of the student. The beginner will find himself talking German *pari passu* with his acquisition of the rudiments of grammar. In fact, any one who will conscientiously master the contents of the work now before us should have no difficulty in making himself thoroughly intelligible on a maiden tour in Germany.

Oriental Carpets. By Herbert Coxon. (London: T. Fisher Unwin.) 1884. Now that so-called "Tapestry" carpets are relegated to lodging-houses and the saloons of sea-going steamers; and when in recently furnished houses the time-honoured "Brussels" of our fathers is giving way to Turkish, Persian, and Indian carpets of more or less authenticity, Mr. Coxon's book will prove interesting to those who wish to know something of the origin of what (while treated as almost a necessity) is, at present, a somewhat costly luxury. The author of this little book, who appears to be in the carpet-trade at Newcastle-on-Tyne, travelled during the year 1883, through Odessa, across the Black Sea, and from Batoum by the New Baku Railway, right down to the shores of the Caspian, diverging when he reached them to visit Resht and Tabreez, and crossing to Kramovodsk, to open up a direct trade in Oriental carpets with the North of England. He tells us of his wanderings in a very unpretentious and readable style; carefully avoiding the two temptations which seem to beset the majority of authors of such books as his—either to be fine or funny. His work will while away an idle half-hour in a train pleasantly enough.

Universal Attraction: Its Relation to the Chemical Elements. By W. H. Sharp. (Edinburgh: E. & S. Livingstone.)—An introduction should be arranged immediately (or sooner) between the author of this work and Mr. Newton Crosland. One of two results would probably accrue: The one being the formation of a New Patent Gravitation Association (Limited); the other, a conflict akin to the feline one in a south-eastern Irish county, which has passed into a proverb.

Watch and Clockmaker's Handbook, &c. By F. J. Britten. (London: W. Kent & Co. 1884.)—Ostensibly addressed to and intended for the Clock and Watchmaking Trades, Mr. Britten's excellent book may be read with interest and advantage by every possessor of a watch or clock in the kingdom. It is arranged in the form of a dictionary, for convenience of reference, and comprises complete and well-illustrated descriptions of every part of a watch and clock, and of the tools used in their construction and repair, short biographies of eminent chronometer-makers, a dissertation on time and the transit instrument, and a map of cognate information. It forms a succinct encyclopædia of horology, and, as such, we can strongly recommend it.

Mineralogy (*Systematic and Descriptive*). By J. H. Collins, F.G.S. (William Collins & Co., London and Glasgow.)—This, the second volume of Collins's Mineralogy, contains a complete and practically exhaustive description of all known minerals arranged upon the chemical system.

No less than 420 woodcuts illustrate the account of the various substances treated of, and as a compendious handbook of the subject on which it treats Mr. Collins's volume is not likely to be soon superseded.

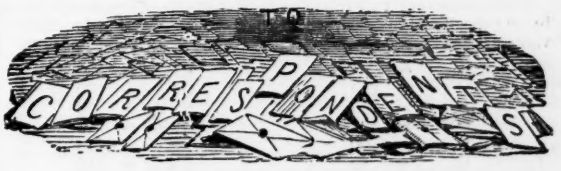
Notes on School Management. By George Collins. (London: Moffatt & Paige.)—Intended on a *vade-mecum* for the school teacher, and well fulfilling the end its author had in view in compiling it, this is a book which will also be found useful by school managers; and, in fact, by all interested in education. The table in pp. 150 and 151 may be studied by those who wish to understand what the promoters of compulsory primary education are aiming at; and to estimate how far the study of the subjects included in the higher standards is calculated to fit the rising generation of the working classes for manual labour. The remarks on corporal punishment on p. 61 appear sensible and judicious.

Botanical Micro-Chemistry. By V. A. Poulsen. Translated by William Trelease. (London: Trübner & Co. 1884.)—Since the invention of the achromatic microscope-objective by Mr. Joseph Jackson Lister in 1829, down to the present hour, the march of microscopy through the field of natural science has been a sequence of triumphs. Were it possible to eliminate the discoveries made with the microscope during the last fifty years from the record of intellectual progress, the sciences of zoology, botany, physiology, and animal and vegetable histology, would be reduced to a comparatively inchoate and rudimentary condition. Time was, and that within the memory of men now living, when the height of the microscopist's ambition was to be able to exhibit with effect some fifty to a hundred "objects," derived from the animal, vegetable, and mineral kingdoms. Now, so specialised has microscopical work become, that the very instrument itself is modified to suit particular branches of research. Chemistry, too, has been pressed into the service of the observer; and various re-agents are familiarly employed in the investigation of minute organic structures. The work of MM. Poulsen and Trelease gives full instructions for the preparation and use of the most approved re-agents employed in the study of Vegetable Histology. It is well written, contains the latest information on the subject of which it treats, and should be possessed and read by all who are interested in the minute structure of plants as developed by the microscope.

Medical Fashions in the Nineteenth Century. By Edward T. Tibbits, M.D. Lond. (London: H. K. Lewis, 1884.)—This is an amusing book, and, we fear, in the main, as true as it is amusing. It is not every day that a physician of standing has the temerity to show the outside public how very empirical an art medicine really is. Most elderly men must recollect the extraordinary change which has taken place in the practice of bleeding within their remembrance, and must congratulate themselves on the practical disappearance of the lancet from the doctor's impedimenta. So, again, with the employment of calomel. These, and the swing of the pendulum from the enormous doses of Dr. Elliotson to the (algebraically speaking) "minus quantities" of the homœopaths, hydropathy, mesmerism, the use—and abuse—of alcohol and anæsthetics, chloral, digitalis, mineral waters, and health-resorts, all furnish our author with materials for his *exposé*. So far, we are in the fullest accordance with Dr. Tibbits. Whether, though, his dicta on the discoveries of Lister and Pasteur are equally sound may, we think, reasonably be a matter for discussion. The inoculation experiments of Pasteur go very far to show that specific forms of disease bacilli actually do exist. Would that they could be got rid of by sneering at them.

Aids to Physiology. By B. Thompson Lowne, F.R.C.S. (London: Baillière, Tindall, & Cox.) This really excellent manual is specially designed for students preparing for examination. It presupposes the attendance at a course of lectures, or the study of one of the larger text-books, and summarises in a form at once succinct and intelligible the results thus acquired. Certainly the student who will master Mr. Lowne's capital little book, need have no fear of being "plucked" by the most exacting examiner. It must not, however, be supposed that it is only useful and interesting to those preparing for a medical career. It is so plainly written and, where necessary, illustrated, that it may be read with profit by anyone and everyone who cares to know anything of the working of that most marvellous mechanism, his own body.

Errata.—Page 199, column 2, "Mr. J. W. Ward" should be "Mr. I. (Isaac) W. Ward"; and "Mr. Mark," "Mr. Marth."



"Let Knowledge grow from more to more."—Alfred Tennyson.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

All Editorial communications should be addressed to the Editor of Knowledge; *all Business communications to the* Publishers, *at the Office, 74, Great Queen-street, W.C.* If this is not attended to delays arise for which the Editor is not responsible.

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The Editor is not responsible for the opinions of correspondents.

No communications are answered by post, even though stamped and directed envelope be enclosed.

STRANGE RESUSCITATION.

[1169]—With reference to a letter signed "John Hame," respecting the plaice which recovered after being frozen for twenty-four hours, and which he appears suprised at and asks for an explanation from the readers of Knowledge, I may perhaps say that fish, in common with reptiles, "both being cold-blooded animals," generally become more or less torpid if subjected to cold, and recover when warmth is applied to them, and not only after twenty-four hours, but after about twenty-four weeks—"a winter." Perhaps with respect to the plaice in question, the warmth of his hands, as well as the shock of falling on the deck, may have brought about resuscitation. I don't know whether he will think this a sufficient explanation, but I think it would have been more surprising if it had been a warm-blooded animal.

Boston, Feb. 26. J. H. Garfit.

RED SUNSETS AT THE CAPE.

[1170]—It appears to me that it is high time we should have some more authoritative and logical explanation of the present (not "late") unusual sunsets than any which have yet appeared. These extraordinary crimson sunsets have been constant here ever since the first week in October last, and show as yet no sign of cessation. The crimson colour on clear evenings is not confined to the western horizon, but shades slightly to the east, and also towards the zenith. Last night it plainly included Venus, Aldebaran, Jupiter, Mars, Saturn, Leo, the Centaur, and Southern Cross, and the red tinge extended as a pale violet even to the zenith, and such has been the normal appearance on every clear evening here since the date above mentioned.

That this phenomenon, extending as it appears to do over the whole earth, can be referred to the explosion in the Straits of Sunda, seems simply impossible; and yet nothing save hypothetical explanations have as yet appeared. Those basing it upon meteoro-

logical states of the weather are quite untenable, for no identical state of the weather could exist all over the globe at once; and I question whether at any moment, since the creation, the state of England and of the diamond fields of Griqualand were hygrometrically or electrically the same. We want spectroscopic and polariscopic observations to account for this world-wide phenomenon.

It is a pity there exists no astronomical observations in this part of the world, an elevation of some 5,000 ft. above the sea, and a climate where there is never any dew, save for a few days after rain, and where ninety nights out of a hundred are cloudless, are circumstances giving advantages for research in physical astronomy not easily attainable elsewhere. Our nearest neighbour, Sirius, crossing nearly our zenith, might tell us something if questioned here.—Yours faithfully, Francis H. S. Orpen, F.R.A.S.

St. Clair, Douglas, Cape Colony,
Feb. 26, 1884.

VALUE OF THE PIECES AT CHESS.

[1171]—Page 209, March 28, you say, "The Chess Column is meant for home Chess players." May I suggest that a table of the *relative value of the Chess pieces* would be instructive and interesting to many? [If it could be trusted.—R. P.]

I will endeavour to explain myself. Suppose the sixteen pieces to be collectively = 1,000, what would be considered the relative value of each?—*e.g.*:—

K	=	0	KP	=	30
Q	=	250	QP	=	30
KR	=	125	KBP	=	22
QR	=	120	QBP	=	22
KB	=	90	KKtP	=	18
QB	=	85	QKtP	=	18
KKt	=	80	KRP	=	15
QKt	=	80	QRP	=	15

1000 C. W.

BLUE SUN.

[1172]—Would you kindly remark on the following difficulty:—Fine particles scatter small blue waves, but allow the larger red waves to go on their course—this explains the blue colour of the sky, also the red colour of the setting sun. According to this explanation, the sunny side of a fine dust-cloud should be blue, and the sun seen *through* the cloud should be *red*, not blue. L. S.

[Dust of a certain degree of fineness would let the smaller waves through and stop the larger.—R. P.]

DARK APPEARANCE OF JUPITER'S SATELLITE IV.

[1173]—I have noticed the frequent remarks of "F.R.A.S.," in his "Face of the Sky," about Jupiter's outer satellites having sometimes been seen as dark bodies when in transit, but I never was fortunate enough to witness anything of the kind until last night (March 12), when there was a transit of IV., commencing at 7.41, and ending at 12.8. I did not witness either the actual ingress or egress, as the sky, unfortunately, was overcast here at both periods, but as it was very clear in the interval I observed, with my 3-in. telescope the greater part of the transit, and during the whole of the time that I observed it the satellite was distinctly visible as a very dark spot, like a shadow, travelling slowly along that very bright part of Jupiter's disc just above; that is, south of the great dark belt. It seemed a strange thing seeing a body which ordinarily is so bright, appearing so dark, and I should like to know how it is accounted for, if indeed it ever has been accounted for. The idea struck me that it might possibly be simply a case of contrast—that is, that the satellite, or at all events the side of it which was then turned towards us, might from some cause or other be so faintly illuminated as to appear dark in contrast with the very bright part of the planet on which it was superposed, and yet be sufficiently illuminated to appear bright in contrast with the dark background of the sky, when not in transit. How far this theory is from being correct you will have more means of knowing than I have.—Yours, &c., Excelsior.

Huddersfield, March 13, 1884.

[That seems unquestionably the true explanation.—R. P.]

VISION.

[1174]—May I inform "Cosmopolitan," (Letter 1147, March 14,) that, although all-seeing is intracranial, there are two kinds of it, objective and subjective—orthoscopic and pseudoscopic. Conscious, intelligent seeing does not take place in the eye, which is only the camera to collect information, but is really a sensation in the frontal lobes of the brain, caused by the vibrations of the optic nerve fibres, communicated by them through several ganglionic centres, of various functions, to the frontal lobes.

Ordinarily light, reflected from surrounding objects, is the normal agent which sets the visual apparatus and machinery working, and then vision is objective, orthoscopic, giving true internal reports and information of external objects and circumstances, sufficient for our safety, edification, and amusement.

But under abnormal circumstances, other *stimuli* than light, even of internal origination, such as irritation, magnetical currents, or congestion of the optic ganglia, &c., may give rise to optic-nerve vibrations, and cause visual impressions, without the existence of any corresponding external object. Vision then is no longer objective, but subjective or pseudoscopic. Such are the horrible visions of the patient in *delirium tremens*, fever, &c. I am glad that optics are to take a more prominent part in Knowledge; they are worthy of its pages. William Wilson, M.A., LL.D.

STRANGE PHENOMENON.

[1175]—The light seen by Mr. Rogers was clearly that of a tolerable-sized meteor, which, for some reason, Mr. Rogers did not see. C. R. Bree, M.D.

TRICYCLISTS AND THE PARKS.

[1176]—The riders of tricycles, whether for pleasure, health, or profit, are forbidden the use of every park in the Metropolis save Finsbury Park. Yet nothing but prejudice can be urged against their right to use at least those parts of the parks now open to hackney carriages. The tricycle, even in the hands of a novice, is more under the rider's control than any vehicle drawn by a horse. Pedestrians have, therefore, nothing to fear from the tricyclist, neither can it be reasonably contended that an equestrian within the park railings would incur greater danger of his horse shying at a passing tricycle than he now does outside them.

F. S. Cobb, Hon. Sec. T. U.

PLANETARY MOTIONS AND THE CONSERVATION OF ENERGY.

[1177]—In your number of March 7, Vol. V., No. 123, you allude to the difficulties of understanding motion in an elliptical orbit and explain the general principle of it very clearly, but can you as easily clear up the difficulty of reconciling the facts of the revolution of the earth with the doctrine of the conservation of energy? This doctrine teaches that there can be no gain of energy without an equivalent loss in the source from which it came, nor a loss without a corresponding gain. But the planets in their elliptical courses are gaining or losing momentum every hour, and the increase in the energy of momentum of the earth between June and December must be enormous; this increase, however, though due to the gravitation of the earth and sun, involves no loss of this energy of gravitation in them, which remains, as is supposed, a constant quantity.

Though I do not doubt the absolute exactness of the law of the conservation of energy, for the old Greek axiom, "Naught comes from nothing and naught to nothing turns," is sufficient proof of it, the empirical evidence in respect to motion of all kinds derived from gravitation seems to me defective; and, were I not afraid of intruding too much upon your space, I would give other instances to illustrate my meaning. J. C. Murray Aynsley.

[This is no instance. In the distance between two bodies there resides potential energy. In planetary movements the distance diminishes as the momentum increases, and *vice versâ*.—R. P.]

STRANGE DREAMS, &c.

[1178]—May I ask the recent contributors to Knowledge of the "strange dreams" and "ghostly visitants" incidents if they would kindly, by sending me their addresses, enable me to communicate with them on the subject?

Other readers of your articles on "Ghosts and Goblins" may have incidents to narrate similar to those given in accounts 1131, 1143, 1144; and I should like to draw the attention of these to the Society for Psychical Research (President, Prof. Henry Sidgwick, Cambridge), one of the objects of which is to systematise such narratives, with the view of obtaining some satisfactory theory concerning them.

We should be specially glad if any contributors on these subjects could favour us by forwarding to myself their names and addresses, not for publication (except by their express permission), but that the evidence for such narratives may be made as nearly complete as possible. Stories relating to premonitory presentiments and dreams, apparitions at time of death, haunted houses, &c., will be thankfully received by the Committee. Richard Hodgson,

St. John's College, Cambridge (Cambridge Branch S.P.R.).

LETTERS RECEIVED.

SENEX.—It would seem that you unconsciously use the right eye only for distant objects.—C. R. BREE.—HUGH MCMASTER. The moons of Mars were discovered in 1877.—W. F. JACKSON. Indexes have been published systematically.—W. G. WOOLLCOMBE. Fear cannot reach Mr. Luxmore.—ALFRED T. JENKINS. Atmospheric pressure at any point depends on total weight of atmosphere above that point. You have only to go high enough to get the pressure low enough, even in the solar atmosphere. Will certainly try to maintain the independent character of the articles, &c. Many fail to note as you do the large part that plays in increasing cost of production. It was a *great* mistake in setting the price of KNOWLEDGE originally at twopence. My own idea was always for the present price.—J. L. You must surely have observed under very unfavourable conditions. All that "F.R.A.S." describes he has actually seen with three inches of aperture.—T. P. BATTERSBY. It is really not our fault if some choose to consider that certain scientific subjects must only be dealt with from a religious standpoint.—C. T. C. WOAD. Many thanks.—G. G. H. Subject is interesting and may have its turn.—H. LEWIN. The idea has been mooted before, but there are serious difficulties. —W. T. BELL. (1) The buoyancy of a body is no greater in twenty feet than in ten feet of water: but precisely the same. (2) The sun exerts no appreciable influence on a burning fire.—A BEGINNER. For your first problem, note that you have not taken the difference of longitude into account,—as you should have done since local time not Greenwich time is in question. Bring London under the brass meridian, and measure off 90 degrees along the equator on either side of the point of the equator thus brought under the meridian. Take a string round through these points and the points on the arctic and antarctic circles uppermost and lowest. It will show you the equal arcs on the latitude parallel of London from sunrise to noon and from noon to sunset. Now do the like for Dublin, or if you prefer it for a point north of London and in the latitude of Dublin. (This will save trouble as the same position of string and globe will serve.) You will find the arcs for Dublin longer than those for London. (2) In the other problem you inadvertently wrote a cylinder where axis passes through the centre of the sphere. Flammarion's illustration is decidedly incorrect. Your best plan is to consider a small cylinder only, in which case the curve of intersection is appreciably an ellipse, of constant minor axis wherever the cylinder meets the sphere, but of major axis (and area) varying as the cosine of the angle, between the axis of the cylinder and the vertical to the sphere at the centre of the ellipse.—ALPHARD. Thanks. —PECCAVI. Who can account for the vagaries of reporters? Have nothing to do with the arrangements made for cutting the paper or leaving it uncut. Quite differ from you in opinion as to the suitability of the papers you mention; to say they are out of place in a scientific journal is to beg the whole question, which is whether the rules discussed have or have not their scientific significance.—J. H. GARFIT. Thanks.—W. POOLE. Never give answers for one person under pretence of answering another. — ONE WHO HAS PASSED HIS LITTLE GO. Probably the fault is that pipe enters tank too near the top. Theoretically pressure at B" ought to be the same, bar effects of friction, whether pipe enters tank near top or near bottom; but practically friction is an important factor.—E. ANDERSON. Thanks very much for the cuttings and the Euclid triangelic. The answer about the Road and the other R is astronomically beautiful.—A. P. WILLIAMS. The moons of Mars are *very* little ones: the largest cannot be much more than one two-millionth of our own in size. You might try Guillemin's Heavens.—FRANK M. Many thanks; but was away from town that day.

ROYAL VICTORIA COFFEE HALL, WATERLOO-ROAD, S.E.—The fourth lecture of the Gilchrist Penny Science Lectures was delivered on Tuesday evening, 25th inst., by Mr. Edward Clodd, on "The Working Man 100,000 years ago." The lecturer began by referring to the scanty knowledge that existed till the last half century about the races living in Britain before and up to the time of the Roman invasion. For convenience, the time from the unknown date of man's appearance to the Christian era is divided into three Ages, those of the Old Stone Age, the Newer Stone Age, and the Age of Bronze or Iron. Traces of the Newer Stone Age are found on surface remains, and witness to a race unlike the Kelts but with whom they mixed. Remains of the earlier or Old Stone Age are found in the mud dredged from the shallow North Sea, in the Thames gravel, in old river gravel called drift, and in lime-stone caverns. Mr. Clodd justified his title by briefly summarising the proof of the enormous age of the deposits in caves and the older Drift, in which worked flint tools and weapons have been found by thousands, witnessing to the presence of man on the earth not merely 100,000 years ago, but probably 500,000 years ago.

Our Paradox Column.

THE FLAT EARTH AND HER MOULDER.

BY H. OSSIPOFF WOLFSON.

II.

IT was in September of last year that I had occasion to make the acquaintance of the wonderful philosopher who styles himself "Parallax." He is passionately fond of his *nom de plume*, and we shall in so far fall in with his wishes by calling him so, although the reader must bear in mind that this is a pseudonym of Rowbotham, which Rowbotham is no other than Goulden, *alias* Tryon, the same individual who at present appears before the public as Dr. Birley. A man who dodges about by different names must have some motive or other for doing so, and we outsiders feel justified to regard such proceedings with a certain amount of suspicion. Men who act rightly carry their names of their fathers to the grave, and are generally proud of them, which they should be, if there has nothing occurred to stain them.

When I made the acquaintance of the many-headed eagle, I knew nothing beyond his *nom de plume*, and his present name. Our first interview has led to many others, and in the result, he succeeded in so far gaining my confidence as to induce me to entirely embrace his cause, and to endorse his teachings. I am here forced to pay him a reluctant compliment, which I have no doubt will very much flatter my old friend. His manners were engaging, and his demeanour self-possessed; and, although intermingled with a certain amount of vulgarity, you would feel as if this was a mere eccentricity of an old man, and far from creating a prejudice against him in your mind, it rather tended to confirm your belief in the veracity of his statements, accompanied, as it generally was, by a face animated with enthusiasm, and with sincerity depicted on it.

Now, if such a man tells you that water is horizontal, and that he saw it with his own eyes, describing the particulars of his alleged experiments on the Bedford canal, how on earth, I ask, can you disbelieve him? Again, if water is horizontal, how can the earth be round? And if the earth is not round, how then could she move in an orbit and rotate on an axis? These are questions enough to rouse you against all the teachings and calculations of Copernicus, Kepler, Newton, La Place, and to provoke your just anger against Mr. Proctor, who, in spite of the self-evident fact, not only ignores it, but continually reflects on the sincerity and character of a great philosopher.

We must, however, leave the astronomical part of our narrative until we come to its proper turn. Let us first see what are the aims and objects of the much despised and *unjustly* persecuted philosopher. I must, however, add, that I was in blissful ignorance of his existence up to last September, and, consequently, knew nothing of the affair of Mr. Hampden and Mr. Wallace. How *could* I know it? The fame of the great philosopher must have been frozen into silence, in her flight, at the very gates of Moscow, and, perhaps, at the very doors of the schoolroom where my education was being enforced upon me at the time. Cherubs did not sing his praises—they must have had something else to engage their attention with at the time. Nor did our Russian journalists, so far as I am aware, open the columns of their respective journals for the discussion of the important subject. And since my sojourn in England, although an ardent student of English literature, the name of "Parallax" did not, up to the above-named date, meet my eye, except as an astronomical term.

It is scarcely necessary for me to ask the indulgence of the readers of KNOWLEDGE for entering into the details of the aims and principles of the man, who, for nearly half a century, has been stumping the country, and making converts to his teachings. He himself professes to seek after *truth*. We shall therefore act on his own advice, and take her scales to weigh him *in propriâ personâ*.

To sum up before we proceed with our actual *exposé*, I will declare in a few words that, which I shall substantiate further on, viz., that "Parallax" is an accomplished *quack*, calling himself now, Dr. Samuel Birley, professing to possess the secret for preserving and prolonging life, but which he also can shorten; who undertakes to cure every disease imaginable for a *guinea* for every two months; the flat earth being only one of the means for decoying the suffering part of humanity, for whose benefit he pretends to live, but whose units, in the meanwhile, assist him in enlarging his fortune, over which he keeps most careful watch. The only wonder is that such proceedings are suffered with impunity—but, then, one must also bear in mind that there is a way to escape punishment—and all those who wish for the same should follow it—let them simply change their names.

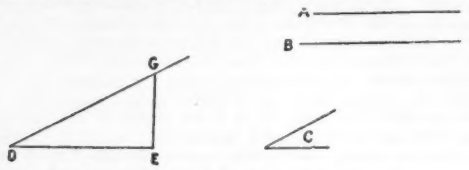
Our Mathematical Column.

NOTES ON EUCLID'S FIRST BOOK.

By Richard A. Proctor.

Prop. 22 is the only one in which Euclid show show to construct a triangle from given elements. But by means of Prop. 23 the following other cases can be solved.

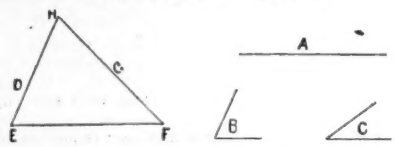
Prop. III.—Prob. *To make a triangle having two sides equal to two given straight lines and enclosing a given angle.*



Let A, B be the given lines, C the given angle.

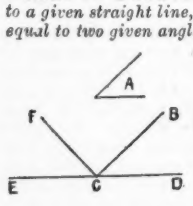
Take a straight line D E equal to A, and at the point D make the angle E D G equal to C. Take D G equal to B, and join G E. Then it needs no demonstration to show that D G E is the required triangle.

Prop. IV.—Prob. *To make a triangle having one side equal to a given straight line, and the angles adjacent to this side equal to two given angles whose sum is less than two right angles.*



Let A be the given line, B, C the given angles. Take E F equal to A, at E make the angle F E D equal to the angle B, and at F make the angle E F G equal to the angle C. Then the sum of the angles F E D and E F G, being equal to the sum of the angles B and C, is less than two right angles. Hence E D and F G meet if produced far enough. Let them meet in H, then E H F is obviously the required triangle.

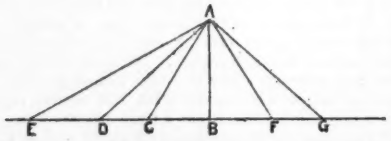
Prop. V.—Prob. *To construct a triangle, having one side equal to a given straight line, and two angles not both adjacent to this side equal to two given angles, whose sum is less than two right angles.*



If A and B C D are the given angles, we obtain the third angle of the triangle, and thus reduce the problem to Prop. IV., by producing D C to E, and making the angle E C F equal to the angle A. For the three angles of the triangle are together equal to the three angles E C F, F C B, and B C D together (Euc. I. 32). Therefore the third angle of the triangle is equal to F C B.

Another case remains, before proceeding to which, however, it will be well to establish the following theorem :—

Prop. VI.—*The perpendicular is the shortest line which can be drawn from a given point to a given line; and of others that which is nearer to the perpendicular is less than the more remote, and converse; and not more than two equal lines can be drawn from the given point to the given straight line one on each side of the perpendicular.*



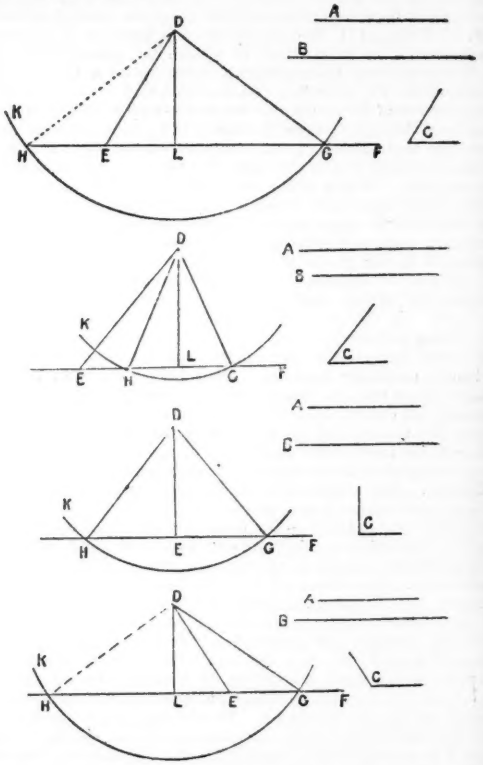
Let A B be a straight line drawn from A perpendicular to E F; and let A C, A D, A E be other straight lines from A to E F, in their order of distance from A B. Then, in the triangle A B C the angle A B C is a right angle; hence the angle A C B is less than a right angle (Euc. I. 17), and A B is therefore less than A C (Euc. I. 19). Also in the triangle A C D, A C D is an obtuse angle, being the supplement of the acute angle A C B; hence A D C is an acute angle, and A C is less than A B (Euc. I. 19). Similarly A D is less than A E, and so on.

Also if A F be drawn so as to make the angle B A F square to he angle B A C (Euc. I. 23), and meeting E G in F (Euc. I. 17, and Axiom 12), the triangles B A C and B A F are equal in every respect (Euc. I. 26), and therefore A F is equal to A C. Also no other line as A G can be equal to A C, that is to A F, because, then, two lines unequally remote from A B would be equal, which has been shown to be impossible.

Prop. VII.—Prob. *To construct a triangle having two sides equal to two given straight lines, and an angle opposite one of these sides equal to a given angle.*

Let A and B be the given lines, C the given angle; and let the side equal to B in the required triangle be that which is to be opposite to the angle equal to C.

Draw a line E F terminated towards E, and from E draw E D making the angle D E G equal to C. Take D E equal to A. From D draw D L perpendicular to E F. Then since D L is the shortest line connecting D with a point in E F (Prop. VI.), if B be less than D L it is impossible to construct a triangle with the given elements. But if B be not less than D L, with centre D and radius equal to B describe the circle G H K cutting E F, produced if necessary towards E, in H and G.



First suppose C an acute angle. Then if B is greater than A, or D G, D H greater than D E, the points H and G lie on opposite sides of E (Prop. VI). Hence by joining D G, we obtain the triangle D E G (and only this triangle), which has the required elements. If B is less than A, the points H and G lie on the same side of E (Prop. VI.), and by joining D H and D G we obtain two triangles D E H and D E G, each of which has the required elements. No demonstration is required in either case. If B be equal to D L, D G and D H coincide and there is but one solution.

If C be a right angle, the two triangles D E H and D E G (which are equal in all respects, however) have the required elements.

Lastly if C be obtuse, it is clear there is but one solution, since D G must be greater than D E that the circle K H G may meet E F in a point between E and F. The triangle D E G clearly has the required elements.

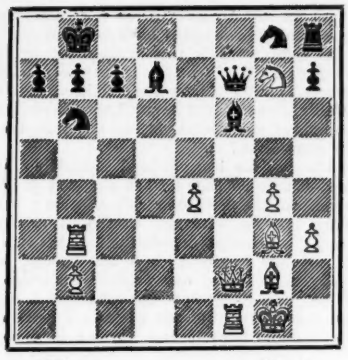
In Euc. I. 5 and 6, we learn two properties of isosceles triangles. And it is to be noticed that the 9th, 10th, 11th, and 12th involve, more or less, the properties of such triangles. It is clear, for instance, that the proof of Prop. 10, does not require that the triangle A C B should be equilateral; but only that A C, C B should be equal. So also, if D F, F E are equal in Prop. 11, the proof is sufficient. In Prop. 12 F C G is an isosceles triangle.

(To be continued.)

Our Chess Column.

By Mephisto.

THE following pretty ending occurred in a game at odds, recently played :—



White.	Black.
R × Kt	RP × R
Q × P	Q × Kt
P to K5 (!)*	P × Q

(The only move, for if either B to B3 or P to B3—to prevent the mate—then P × B, or B × B would be fatal.)

P × B (ch)	Q to B2

(If K moves, R mates.)

P × Q and wins.

"There is nothing new under the sun!" The prettiest and most brilliant combination in a game may very often be due merely to a recollection of what had previously actually occurred, or analytically shown to be possible in positions similar or closely resembling those from whence the combination arose. A practical player knows that in each opening, in reply to a particular move, a certain attack is possible. The better a player knows the openings, and the more experience he has, the more dangerous he will become as an adversary, by being able to take prompt advantage of a weak move. In the following pretty game we have a recurrence of a fine finish which has occurred to us before several times in games printed in Knowledge. In the present instance, however, the game opened in a different manner from those previously recorded.

Game Played by Mephisto and a Strong Amateur.

White. Mephisto.	Black. Amateur.
Hampe Algaier.	
1. P to K4	P to K4
2. Kt to QB3	Kt to QB3 (*a*)
3. P to B4	P × P
4. Kt to B3 (*b*)	P to KKt4
5. P to KR4	P to Kt5
6. Kt to Kt5	P to KR3
7. Kt × P	K × Kt
4. P to Q4 (*c*)	P to Q4
5. Kt × P	B to K3
6. KB to B4	Kt to K4 (*d*)
7. B × P (*e*)	K × B
8. Castles (*f*)	K to Kt3 (*g*)
9. Q to Q3	Kt to Q3 (*h*)
10. P to R5 (ch) (*i*)	K × P
11. B × Kt	B × B
12. P to K 5 (*j*)	B × P (*k*)
13. P × B	Q × Kt
14. R to B5 (ch) (*l*)	B × R (*m*)
15. Q × B (ch) (!)	K to R5
16. P to Kt6 (ch)	K to R6
17. Q to Bsq (ch)	K × P
18. Q to B2 (ch)	K to R6
19. Q to R2 mate	

* [But why not Q takes P(ch), followed by Q to QR5, mate? Possibly, however, the position, as seen by me in proof, is incomplete?—R. P.]

NOTES.

(*a*) This is considered best, and is called the Vienna, or Hampe, game. B to B4, or B to K2, are considered less satisfactory replies for Black. Kt to KB3, which is followed by 3. $\frac{\text{P to B3}}{\text{P to Q3}}$ 4. $\frac{\text{P to Q4}}{\text{P to Q3'}}$ &c., lead to an even game.

(*b*) With 4. P to Q4 we have the Steinitz Gambit, to which the best reply is Q to R5 (ch). 5. $\frac{\text{K to K2}}{\text{P to Q 4}}$ 6. $\frac{\text{P × P}}{\text{Q to K2}}$ (ch), &c.

(*c*) This move now transforms the opening into a Hampe-Algaier, which is believed to be richer in attacking variations than the ordinary Algaier attack, without the development of the Q Kt.

(*d*) Kt to R4 in the beginning of a game is very often but a precarious resource, as it loses time and puts the piece out of play. B × Kt would not have been good, as after B × B (ch) the White Q can capture the unprotected KtP. We believe 6. Kt to B3 might have been played here, threatening Kt × Kt. Black has nothing to fear from 7. $\frac{\text{Kt × Kt}}{\text{B × B}}$ 8. $\frac{\text{Kt × P}}{\text{Q × QP}}$ 9. $\frac{\text{Q × R}}{\text{Kt × Q}}$ 10. $\frac{\text{Kt to K5 (ch)}}{\text{KtK3}}$ 11. $\frac{\text{Kt × B}}{\text{Kt × P (ch)}}$, &c.

(*e*) Taking advantage of the position for the purpose of attack at the expense of another piece.

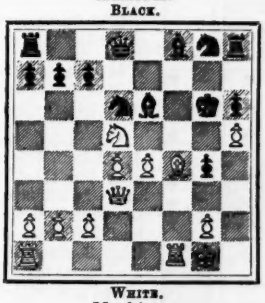
(*f*) Threatening to win the Q.

(*g*) Zukertort advocates K to Kt3 in similar positions in preference to K to Kt2, to avoid the attack of the White QB. If K to Kt2, then 9. P to QKt3, with the object of gaining the square on K5.

(*h*) If White plays 10. $\frac{\text{B × Kt}}{\text{B × Kt}}$ 11. $\frac{\text{P to K5 (ch)}}{\text{KtKt2}}$ 12. $\frac{\text{P × Kt}}{\text{B × Kt}}$ Black has a defensible game.

(*i*) Black has no alternative but to capture the P; for if K to R2 then follows 11. B × Kt threatening 12. P to K5 (ch), and mate by Q to Kt6. K to B2 is, of course, inadmissible on account of the discovered check by the B and R. We give a diagram of the position.

Amateur.
Black.



White.
Mephisto.

(*j*) Threatening Kt to B4 (ch), followed probably by Q to K3, &c.

(*k*) Black had no good move at his command to avoid Kt to B4.

(*l*) This was unforeseen by Black. The mate following this move is very often made possible, even under slightly altered circumstances, provided the Black King has to go to R4. We have had several opportunities for *administering* it before.

(*m*) A vain hope.

The fourth of the series of Gilchrist Penny Science Lectures was delivered on Friday evening, 21st March, on "Air and why we breathe it," by Wm. Lant Carpenter, Esq., to a numerous and deeply interested audience. After demonstrating experimentally the weight and upward pressure of the air, he referred to its chemical constitution and successfully performed several brilliant experiments, illustrating the changes produced in air by combustion and by respiration, pointing out the source of the carbonic acid in each case. The properties of this poisonous gas and the lime-water and other tests for it were carefully demonstrated. The oxyhydrogen lantern was then employed to exhibit tables of the composition of air under various conditions, methods of ventilation, &c. The statement that the air of the Vic. contained only ten parts of carbonic acid in 10,000 of air, as against an average of 16 parts for London theatres, and three parts for fresh country air, excited sympathetic applause, as did also the lecturer's concluding references to the evils of the present fashion of tight-lacing, illustrated by photographs on the screen of Paris fashion books contrasted with the Venus of Milo and with Miss Mary Anderson as Galatea.

Our Whist Column.

By "Five of Clubs."

THE following game was played recently in the Editor's home circle, *Y*, *Z* being respectively the Editor and Mrs. Editor; *A*, *B* other members of the family circle.

The Hands.

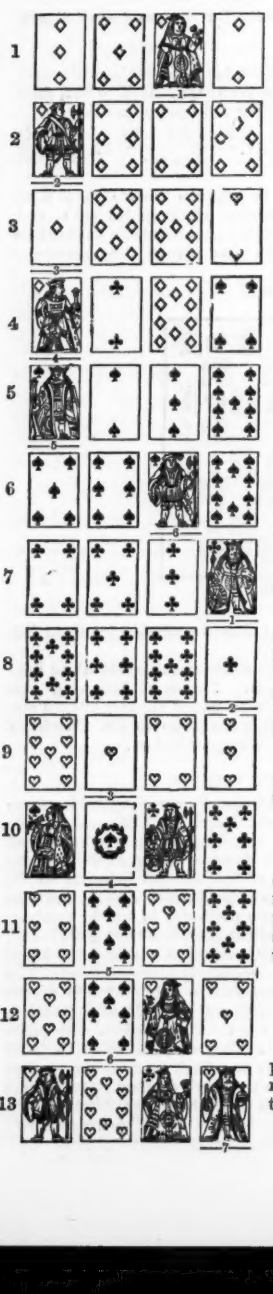
B { *Diamonds*—Q, 10, 9, 4. Hearts—Q, 7, 4. / Clubs—Q, Kn, 9, 3. Spades—Kn, 3. }

Y { *Diamonds*—8, 6 5. / Clubs—6, 5, 2. / Hearts—A, 10. / Spades—A, 8, 7, 6, 2. }

A B, 3. **B**
Dealer.
Y **Z**
Y Z, 4. *Trump.* D. Q.
Leader.
A

Z { 2, 7—*Diamonds*. / 7, 8, K, A—Clubs. / 2, 3, 5, K—Hearts. / 9, 4, 10—Spades. }

A { *Diamonds*—A, K, Kn, 3. Hearts—Kn, 8, 9, 6. / Clubs—10, 4. Spades—K, Q, 5. }



NOTES AND INFERENCES.

1. *A* regards the game as won because with the four honours nothing can save *Y*, *Z* but making the odd trick, which with such cards as *A* and *B* hold between them—to *A*'s knowledge—seems unlikely.

2 and 3. *B* has shown by the return of the small Diamond that he held four. But *A* is a rather young player, who has not as yet learned duly to notice such points. Accordingly,

4. *A* draws partner's last Trump instead of the adversaries'.

5. *Y* does not cover the King, as he sees it is important to win the third trick in Spades.

6. Still *Y* passes the trick. Apart from the necessity of winning the third trick in Spades, there is a chance that *Z* may win the second. However, it is won by *B*. Observe that *Z*'s discard at trick 3 shows *A* that Hearts are *Z*'s longest suit (Trumps being declared against *Y-Z*).

8. *Z* is quite right, as the game and score stand to secure a trick in Clubs before leading a Heart. Every trick has to be made to save game, so that retaining the King card of opponent's suit would here be of small use.

9, 10, 11, 12, 13.—The rest of the game plays itself. *Y-Z* win the odd trick.

The game is given, "errors included," precisely as recorded immediately after the hand was played. It shows that a game should not be regarded as lost until it is won, nor *vice versâ*.

Answer to Correspondent.

Q. T. V.—Meaning that his partner should at the end of the round know what *Z* knows (also at the end of the round).

A WHIST-PLAYER'S WAIL.

By the Author of "Bumblepuppy."

Whist-players have long been suffering acutely from three uncertainties—uncertainty of the laws, uncertainty of decisions, and uncertainty of authority. I propose to consider these three points, one by one, and then to suggest a remedy or two.

The laws are ninety-one in number, and, in "Cavendish on Whist," are supplemented by forty-three explanatory notes and a couple of suppositions, which again have been further explained—if explain is the right word in this connection—by innumerable irresponsible decisions. Now, though it may be Utopian to expect such a badly-worded jumble of laws and definitions ever to be superseded by an intelligible code, is it impossible to have these decisions based on a principle of some kind, or, at any rate, for them to be consistent with themselves?

At one time the decider has confined himself to the strictest letter of the law, at another time he has strained it to breaking; sometimes he has read the laws one with another; sometimes he has taken one and left the other out in the cold; sometimes he appears arbitrarily to give his decision out of his own head, quite irrespective of any law whatever; and finally, and worst of all, after consistently maintaining one position for years and years, until—rightly or wrongly—some doubtful point is settled, he suddenly turns round, with his tail where his head always used to be, flatly contradicts himself and throws it once more into confusion.

The usual excuse for a *volte face* of this kind is, "that this is a free country, where every man has a right to change his opinions"; and I never hear that dreadful exordium without instinctively making for the door, knowing from bitter experience that mischief is brewing. "That judges themselves differ, and the judgment of one court is often over-ruled by another," this also is, I am afrad, true, though it has no bearing on the matter in hand; for here we have a judge who, on his appointment to the bench—granting, what is strongly disputed, that a Whist arbitrator is a judge and has a bench—having found a well-establishment precedent and taken it for his guide in numerous judgments, one fine day reverses it without notice and without leave to appeal.

(*To be continued*).

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MR. R. A. PROCTOR'S COURSE OF LECTURES.

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3. THE MOON.
4. THE PLANETS.
5. COMETS.
6. THE STAR DEPTHS.

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The following arrangements are complete: the numbers in brackets referring to above list.

LONDON (Brixton Hall) April 4, 8 (1, 2, 3, 4).
CRYSTAL PALACE, April 7, 9 (1, 3).
BIRMINGHAM (Town Hall), April 18, 23, 25, 28; May 2 (1, 2, 3, 5, 6).
LEAMINGTON (Royal Music Hall), Four Afternoons, April 17, 19, 24, 26 (1, 3, 5, 6); Two Evenings, April 17, 24 (2, 4).
St. HELEN'S (Lanc.), April 22 (2).
COVENTRY, April 30, May 1 (1, 2).
MALVERN, May 3, 17 (Afternoon) (2, 3).
LLANELLY, May 5 (1).
SWANSEA, May 6, 7 (1, 2).
WORCESTER, May 8, 9, 15, 16.
BANBURY, May 14 (Afternoon and Evening).
OXFORD, May 12, 13, 19, 20.
CAMBRIDGE, May 21, 22, 23.

Note.—*All communications respecting Lectures should be addressed to Mr. John Stuart, Royal Concert Hall, St. Leonards.*